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ELECTRICAL POWER DEVELOPMENTS IN PERU.

It may confidently be expected in the development of new countries, that is to say, those countries which are backward as compared with European and North American standards, that electrical systems will play a very great part. This is particularly true respecting those countries where there is an abundance of hydroelectric power. Such, for example, is Peru, and on another page of this issue we publish an interesting discussion of a proposed development in that country. Mr. Emile Guarini, who contributes this article, has made a special study of the situation in Peru, and is earnestly advocating energetic development of that country's water powers, of which there seems to be an abundance. This might be expected since the eastern part of the country, through which the Andes pass, is very high and the decline toward the coast is rapid.

The question, however, is not entirely simple, since it involves other not less important developments. One of these is the irrigation of the farm lands, the western section of Peru being practically rainless. For this reason the water can not be carried all the way down the slope and there used for driving turbines, but must be used at a point from which it can then be turned into irrigating ditches. In spite of this limitation there remain available in Peru large water powers which, if properly developed and transmitted by modern methods, will make available cheap power throughout large sections of the country. In this development the main consideration at the present time seems to be securing the money to carry on the work. However, the country is probably not yet ready for wholesale electrification. The process must come slowly, and time allowed for change from the present primitive methods to those more modern. This is particularly true in the agricultural districts, since here electric power can only be applied when suitable apparatus for utilizing it is available.

Probably one of the most important of the early developments will be the electrification of certain railways, and possibly the construction of light railways to meet immediate needs. Mr. Guarini suggests that what he terms "electrothermic traction" could be applied with advantage in Peru since the railroads run only in the daytime and the electric power is now mostly used for lighting purposes. By "electrothermic traction" he means the installation of an electric heater on the present steam locomotives, the electric power being used then merely to raise steam, and in this way taking the place of coal. It may be that there are some situations where such a system could be applied economically, but they are only the ones in

which the conditions existing at the particular point he discusses in his article obtain. Moreover, if electric power is to be used for other purposes than lighting, there will be certainly large demands for it during the day, and it will probably not be long before there will be a demand for some night service on the railways. The system would then be merely a temporary expedient, one offered to get around the necessity for purchasing a large equipment at the present time.

Although simple, this system proposed is technically bad, because it will require about ten times as much electrical energy to operate in this way as would be necessary if electric locomotives were adopted, and this, of course, calls for the installation of a transmission and distribution system ten times larger than that needed for an equivalent electric system. If the power stations supplied power to the railways alone, this condition would be carried back to the station, requiring enormous equipments there, but in the case discussed, the plan contemplates merely the use during the day of power from a station which will be erected for other purposes which need current during the night-time only, and the idea is merely to save the expense of electric locomotives. If adopted, the steam locomotives could be replaced gradually by electric, thus making possible increased economy of operation as well as increased traffic facilities. It is a question, however, whether even under these conditions the system proposed is advisable. Might it not be better to follow the plan adopted in Switzerland, where, as Mr. Guarini notes, the electric system is being introduced gradually, and the steam locomotives are continued in service until they can be replaced? Switzerland also is a country without fuel, although the cost of coal there is not as great as it is in Peru.

THE GROWING IMPORTANCE OF WATER POWERS.

We have occasionally called attention to the increasingly important position occupied by the water powers of any country. This is a resource which, if carefully guarded, is inexhaustible. It is not like a deposit of coal or oil, which, however large, must come to an end some time. It might more properly be compared with the forests of the country, although the latter, as a power resource, are of little importance. Their chief value lies in other directions, and one of the chief of these is their use in regulating the flow of rivers which are used for developing power.

In nearly all industries one great need is cheap power, and this need has become relatively greater in recent years, due to the introduction of improved machinery, particularly of the automatic type, and to the development of new methods in which large amounts of cheap power are essential. It is obvious, therefore, that the proper care and development of the water powers of the country is a problem of great importance, and in the long run those countries which can produce the greatest power will have a great advantage over other countries less fortunately situated, and must in the end forge ahead.

In another page of this issue, we present a brief abstract of a discussion of one aspect of this problem; this is the political side of the question, and it is there pointed out the peculiar situation which exists in the neighborhood of Niagara Falls. Here, as is well known, vigorous agitation has resulted in governmental restriction of the amount of power which may be developed. This applies to both sides of the river, and at the present time much power is being generated on the Canadian and transmitted to the American side. Many and important industries may thus become entirely dependent for their operation upon power generated in Canada, and the question arises, "What would be the result of a disagreement between Canada and this country, which would result in the cutting off of this supply of power?" Fortunately such dependence of either country upon the other helps to make such a misunderstanding less possible.

Another effect of the power resources at Niagara, it is said, will be the concentration there of the principal industries of the country. The author believes that the centre of population will no longer move westwardly, but he believes it actually will move toward Niagara, which will eventually became the industrial centre of the country. There is no doubt that the neighborhood of Niagara Falls will become a very important manufacturing centre, but the writer of this article does not appreciate the vast opportunities existing in the western part of this country, nor does he seem to realize how large a part of the country that called the "West" really is. It is certain that the centre of population will continue to move westward for many years to come.

He also fails to realize the importance of water powers available at other points of the country, and particularly in the Far West, where, although the streams are relatively small, the heights of fall are relatively great. At the present time, with the exception of Niagara Falls, the most important hydroelectrical installations in operation are in the Far West, but there are also enormous powers available, and many of them are being developed, in other parts of the country, and some of these which are not so large in actual available power are extremely important because they are comparatively near large industrial centres at present existing. Such for example is the development at McCall's Ferry on the Susquehanna river. Another important region is in the southern states, where there are many large rivers presenting very advantageous sites for developing power which will certainly be used in building up that section of the country. Indeed, there are a number of strong organizations at work in the South, developing these powers and creating large distributing systems by means of which they tie together many generating stations and feed large sections of country, and thus supply cheap and reliable power.

The main conclusion of the article referred to above is that England at present possesses a decided advantage, as regards cheap power, over other countries. This country is said to be at a disadvantage because of financial and industrial unrest, although we have not realized before that the unsettled stock market had in any way retarded the development of those waterfalls where power is most needed. It is said that the

supply of coal in England is apparently inexhaustible, and this gives her a cheap source of power which she should use in developing her industries, and in this way forge ahead of every other country. Scandinavia possesses most valuable water powers, but recent governmental restrictions prevent its development by foreign capital, and domestic capital is not available. Germany, it is said, is depending too much on foreign fuel supplies. Hence the opportunity for England, which is thought to lie in the application of electric power to industrial processes. The author overlooks how rapidly this is going on in this country. In this respect, we are certainly not behind England, and we are not likely to advance any slower. Given in addition cheap power secured from waterfalls, it is hard to see how England is to leave us far behind. In fact, if the application of electricity to industrial processes there meets with any such restrictions as have retarded its use in cities, England may soon find herself far in the rear of the other great countries. If she expects to develop electrically, the government should encourage, rather than discourage, electrical applications.

It is true, however, as is pointed out in this article, that one of the most important problems which will require governmental attention will be that of protecting and encouraging the development of the country's water powers. In this country, fortunately, it is not the custom to place difficulties in the way of such developments, but on the other hand, there are other questions, such as the conservation and regulation of the rainfall and run-off. This is a problem requiring the preservation of our forests, and is one which necessitates the cooperation of the state and Federal governments. Only by the preservation of our forests can we maintain a fairly uniform flow of water in the streams, and in this way make possible the utilization of at least an appreciable part of the energy represented by the flow of water from the mountains to the sea.

AMERICAN ELECTROCHEMICAL SOCIETY.

The fall meeting of the American Electrochemical Society will be held, as usual, in New York city. This is according to the arrangement made some time ago by which it was agreed to hold two meetings a year; the one in the fall being short and held in New York city, where there are so many points of interest to be visited. The dates selected are October 17, 18 and 19, the meetings for discussion being held on the last two days. A full programme of papers has been prepared, a number of these dealing with the electric furnace. Also, several lectures have been arranged for upon topics of exceptional interest. If the success of the last spring meeting of the society, which was in Philadelphia, is an indication, there should be a good attendance at the coming meeting and a lively discussion. It is to be hoped that the members of the society will see to it that it is maintained in a proper, vigorous and healthy condition. It has already done good work, and may be expected to do more, and the field to which it is devoted is one of great and increasing importance.

GOVERNMENT SUPPORT OF SCIENCE.

An interesting article, dealing with the financial support granted to science by the government of this country and that of Great Britain, is given in *Nature*, September 12. It is pointed out first that the adoption of scientific methods in the management of the affairs of state is a preliminary necessity where government efficiency is to be secured, and attention is called to the unfortunate lack of appreciation of this which the average British official has. The public at large seems also indifferent in the matter in spite of the fact that it sees scientific methods applied in nearly all other branches of human activity, and always with the best results. In fact, if manufacturers and others do not turn to the new methods, they soon find themselves driven to the wall. It is strange, therefore, that in one of the most important branches of human effort, that of government, so little attention should be paid to the application of scientific methods. And it should be understood that a scientific method means here simply a systematized and orderly way of doing work, which is to say, an efficient and economical way; a method in which the desired end is carefully thought out, and the best way of attaining it determined upon.

While the writer of this article holds up as an example the liberality of our Federal government in this respect, and shows how sadly his own government is lacking in comparison, we could well extend the system, not only in the general government, but to the various state and municipal governments. The latter are noteworthy as examples of inefficiency and wastefulness.

In the comparison of the two governments, it is shown that the United States spend yearly over $13,700,000 for scientific purposes. This does not include grants for educational purposes. This money is spent for purely governmental purposes. Compare this with the sum spent annually for similar purposes in Great Britain, which is said to be but a little over $1,200,000. The revenues of the two countries are given as $762,375,000 for the United States and $719,885,000 for Great Britain. That is to say, although the income of the United States is only five per cent greater than that of Great Britain, the government spends over eleven times as much money in scientific work; in other words, it attaches eleven times as much importance to scientific systems as does the country which gave birth to Newton, Darwin, Maxwell and Kelvin, and a great host of other scientific pioneers.

THE NEW YORK ELECTRICAL SHOW.

On the evening of September 30 the electrical exhibition under the auspices of the Electrical Show, Incorporated, was opened at Madison Square Garden, New York city, a very large attendance being registered. The show will run until October 9, and from present indications complete success will attend the efforts of the management, which is to be congratulated upon the auspicious opening and the very creditable showing made. In addition to the smaller devices which will interest every householder, there is a fine display of machine tools, testing apparatus and advertising and decorative lighting.

Hydroelectric Central Station of Charcani at Arequipa, Peru.

By Emile Guarini.

THE Sociedad Electrica of Arequipa, which has recently been formed, owns a hydroelectric station situated at Charcani, about one and a half miles from Arequipa. To this central station was recently added a three-phase generating unit, bringing the available power output to about 1,000 horse-power. The station utilizes the water of the river Chile. At the time of my visit, the three-phase line intended to distribute, during the day current for power, and at night to complete the lighting at Arequipa, had not yet been installed. It will, therefore, not be discussed here. This new generator is a three-phase machine, driven by a Francis turbine with an output of 528 horse-power, and delivers fifty-two amperes at 5,400 volts and a frequency of fifty cycles.

The supply canal has a length of 4,200 feet, and a capacity of 140 cubic feet a second. The fall at present utilized is about eighty-seven feet, thus making available a maximum theoretical power of 14,013 horse-power and an effective power at the axle of the turbine of about 1,060 horse-power.

The two turbines forming part of the original installation use each thirty cubic feet of water a second and are rated at 248 horse-power each. This gives the pair an output of 496 horse-power. These turbines each drive a single-phase dynamo delivering alternating current at fifty cycles and 5,400 volts.

The high-tension line has a length of about eight miles, is supported on 245 poles and consists of eight bare wires each with a cross section of 32,000 circular mils. The high-tension current is transformed at different places in Arequipa to 110 volts by sixteen static transformers varying in output from twenty to two kilowatts. These transformers are mounted in parallel. At present at Arequipa there are ten arc lamps with a nominal rating of 1,000 candles, and incandescent lamps of variable candle-power aggregating 4,391 lamps. At the time of my visit, the total lighting furnished was estimated at 77,972 candles.

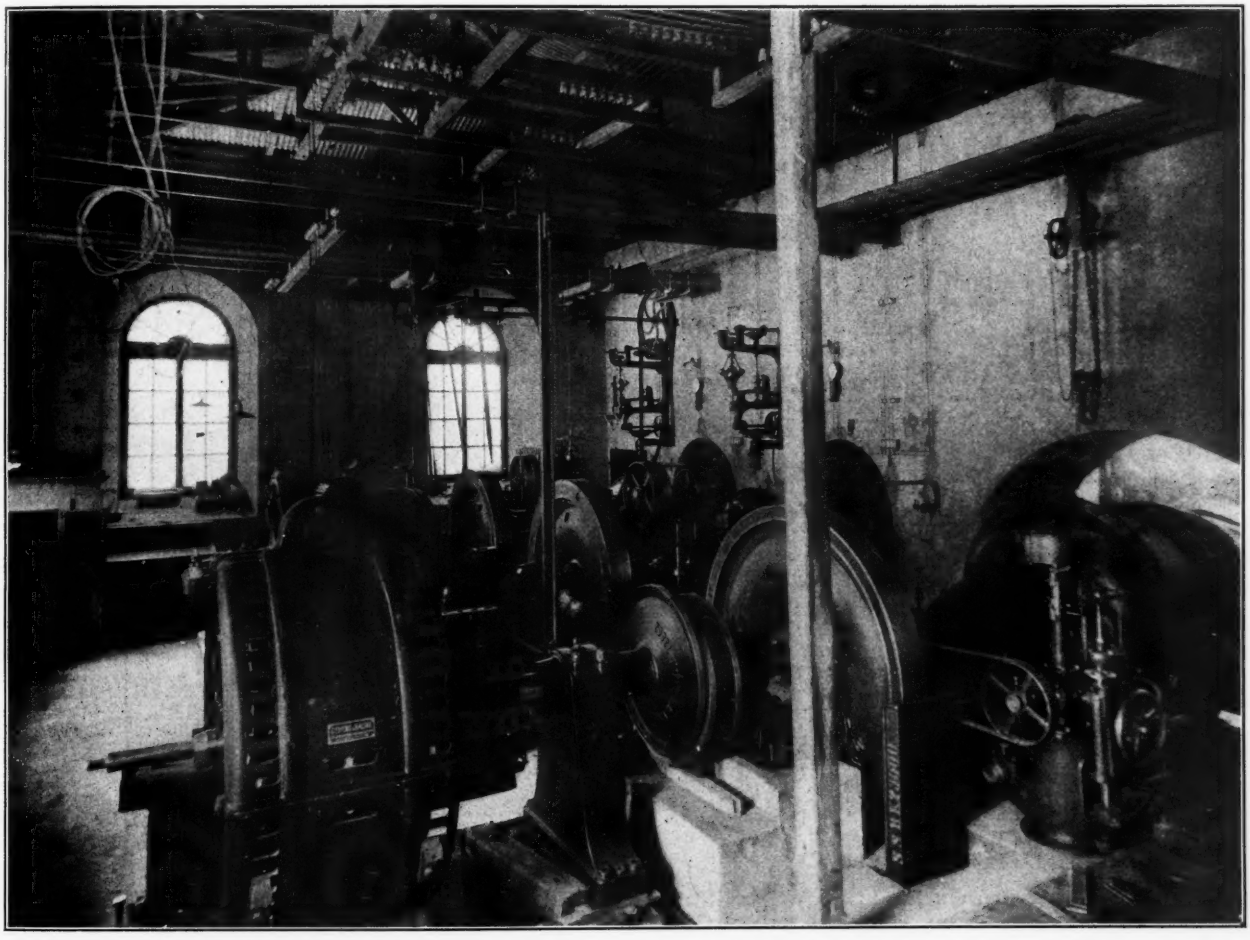
The question is raised whether the available power is sufficient for this load. In deciding this it is well to recall certain complaints made by the public and the city officials, and to see whether they were justified. The generating station at Charcani transmits 300 kilowatts to the town. Assuming that the electrical losses are on an average twenty per cent in the high-tension line transformers and distributing system, this gives the relatively high efficiency of eighty per cent for the system. There are then available for lighting 240 kilowatts. As the lighting by incandescent lamps is carried out with lamps of the ordinary type, without overloading the generators and transformers, one can then supply simultaneously 60,000 candles, about seventy-seven per cent of the lamps installed. This is not sufficient in the hours of heavy lighting, unless the transformers and generators be overloaded, which is not well to do for a long time nor habitually. On the other hand, it must be remembered that thefts of current take place, as in fact has been shown to be the case elsewhere. This occurs in two ways: by changing the lamps to lamps of higher candle-power, and by making unallowed installations. This occurred in Lima, as the undertaking there could not maintain that rigorous inspection of the system which it desired. In consequence, although a relatively low consumption of current was allowed for, in reality the average consumption has been rather high. Furthermore, it is unfortunately the case at Lima and elsewhere that the lamps are kept in service too long, even until they are burnt out. During the life of the lamps, consumption of energy per candle increases and the light produced decreases. Thus, for example, a good lamp of sixteen candles, 110 volts, when supplied from a system with good regulation, after 1,000 hours, takes from five to six watts per candle and gives only eleven and one-half candles. If the lamps be bad, and if the variations of potential are marked and numerous, the effects are disastrous; variations in potential are more pernicious at the lamps than the mechanical variations due to the same trouble. In these conditions it is possible that after 600 hours of lighting a lamp has a luminous intensity of one-half that it had at the beginning, although it takes double the current per candle. Hence the false conclusion is reached, which unfortunately the public can not understand, that the station should give double the current because the consumers receive but half of the agreed upon illumination. Neither the consumer nor the supply company is satisfied, and each accuses the other of dishonesty. Whose fault is it? I divide the responsibility. The apparent fault belongs to the client who does not change his lamps; the real fault lies with the company for two reasons: first, because it does not teach its clients the reciprocal advantage of changing the incandescent lamps more frequently, second, because it sells these lamps at too high a price and monopolizes the sale. This monopoly is not always complete and effective because, although in theory the company can prevent its client from using other lamps, in practice, nothing can prevent this. The undertaking should be interested in supplying the lamps at wholesale, leaving the sale of them free to supply houses, so that the result would be to reduce to a minimum the cost of the lamps. By doing this both the public and the enterprise would be helped; doing otherwise is simply mismanagement.

To justify Sociedad Electrica of Arequipa, it should be noted that current is not sold by meter, as there is but a single meter for measuring the total output and the rest is sold at a flat rate per lamp. It might seem that the control of the sale of the lamps, and selling them at a high price, would be one means of preventing fraud. This is an inaccurate and dangerous conclusion, since one client particularly, if he has a large number of lamps, will hesitate to renew at an expense of fifty cents a lamp which costs but twelve and a half cents. As to frauds entering, there is no evidence, since the client who knows that he is paying for sixteen candles and who, on account of the overload of the system or use of poor lamps, gets only eight feels that he ought to be able to put on more lamps in order to get the sixteen candles for which he pays. This can not justly be called fraud, as it is nothing of the sort.

Another strange thing which happens frequently at this installation is a cutting off of all the private and public lighting. This phenomenon occurs always at the same hours, and lasts for about the same time. I attribute it to malicious interference with the high-tension lines.

In conclusion it can be said that the Arequipa undertaking did not, at the time of my visit, give that reliability for which

it was being paid, and this was due only partially to its own fault. With the additional 500 horse-power equipment, which is being installed and which possibly, at this time, is in operation, it should be able to supply the demands very satisfactorily. At the time of my visit, the two 248 horse-power machines which were then running, could guarantee the lighting of the district only when economical lamps were used. If this undertaking intends to supply moderate lighting, public or private, at Arequipa where both services may be extended widely, it will be necessary, sooner or later, to install a new hydroelectric plant. Power for this is to be found upon the same river where the present plant is. The Chile and other rivers represent a colossal hydraulic power which is but little appreciated by the people of Peru. If it were allowable to adopt the brilliant suggestion of M. Habich, the director of the School for Engineers at Lima, an almost incalculable power could be secured, as the rivers of Peru descend in their courses to the coast from heights of from 10,000 to 16,000 feet. He proposed that a commission be appointed to make thorough studies of this question and pointed out that it would be easy today to secure and utilize these forces since, by means of electrical transmission, a power can be transmitted to great distances and applied to all purposes, both in agriculture and other industries. M. Habich also showed that the river Rimac alone offers 1,000 effective horse-power, and he urged the earnest consideration of the effect upon Peru of utilizing the water power which she possesses so abundantly.



A View in the Charcani Central Station, Arequipa, Peru.

Although the Chile river, which we have been considering, descends from only a moderate height, the point where the Charcani station is now situated is a little more than 10,000 feet above sea level. Charcani itself is about 2,500 feet higher than the lower part of Arequipa. The flow at that altitude is 200 cubic feet a second; thus representing a theoretical horse-power of 240,000. By a suitable canal system carried to the sea and starting only from Charcani, from 100,000 to 120,000 available horse-power could easily be obtained. However, in that case this water could not serve for irrigation after passing through the hydroelectric station. Now the government of Peru is earnestly endeavoring to increase, in a large measure, the volume of water in the Chile river which is used for agricultural purposes. This is an obstacle to the plan suggested above, and to the complete utilization of water power on the coast side of Peru. On the east side of the mountains, water is abundant, and this obstacle does not present itself. For this reason it is necessary on the coast side to utilize only the upper courses of the river, those actually in the mountains; but this is not a difficult task for the modern engineer; and thus the lower part of the river would be left free for irrigation purposes. It is this latter solution which I propose for relieving the situation at Arequipa.

By going down stream from the station about 1,300 feet, it is possible to increase considerably the available power, since at that point a fall of over 300 feet can be secured in place of the eighty-seven feet

utilized, and it is in point to state that this can be done without any prejudice to the irrigation, since there are no irrigating ditches between the lower site suggested and the present plant.

By utilizing the present canal, which could be extended, there would be available 4,000 effective horse-power. By constructing a new canal capable of supplying 200 cubic feet a second, which is the available minimum flow of the Chile river, the effective horse-power would be about 6,000.

Among the uses of this current during the day, I suggest the electrification, total or partial, of the Southern Peruvian Railway. This use during the day is suggested for two reasons: First—because trains are run only during the day at the present time, and second—because the power produced at night would make possible a considerable extension of the public and private lighting at Arequipa and its environments.

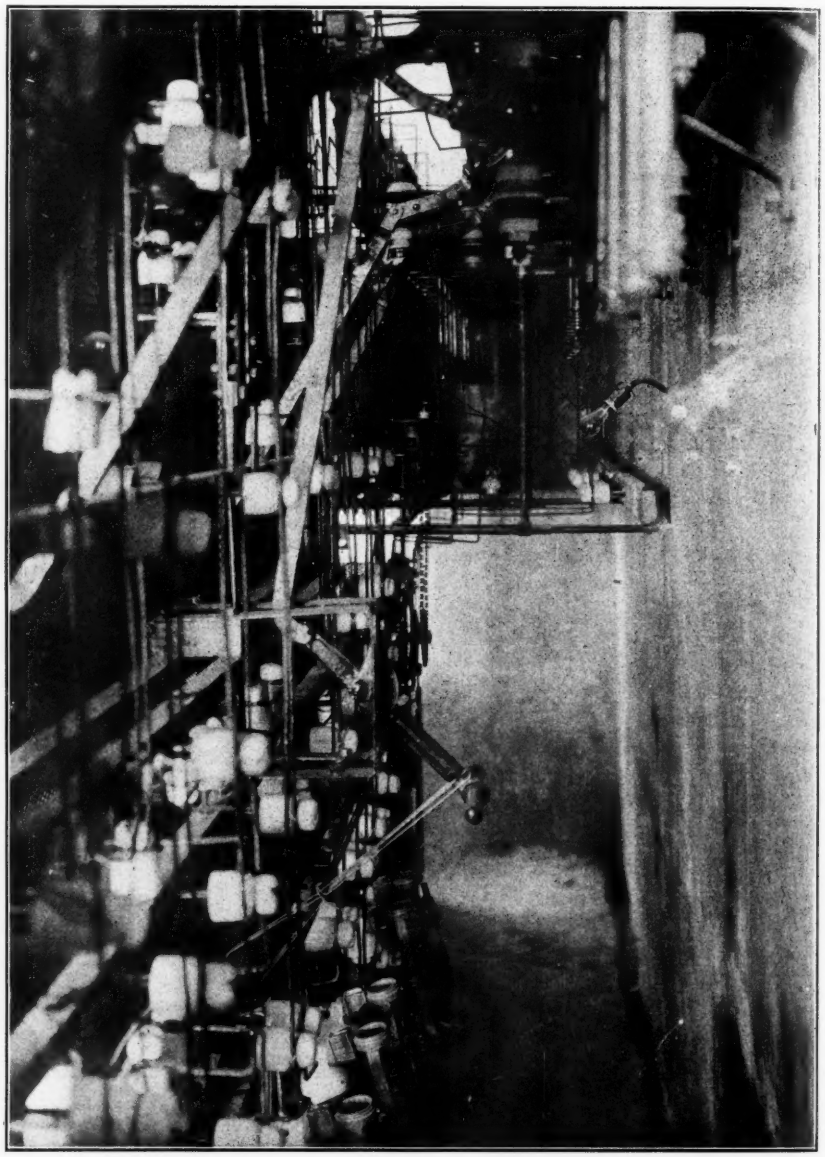
There are then five questions arising which require answers: First—Would the current produced be sufficient to operate the actual train service and the traffic which may be expected in the future? Second—Can the current be transmitted far enough to feed economically the railway system, and those extensions which are to be expected? Third—What type of electrical equipment should be adopted? Fourth—What kind of current and what voltage should be used for transmission? Fifth—Can any economy be realized by transformation to electric traction?

Regarding the first question. The electrical losses allowed for are generally about one-third as a maximum. This would leave about 4,000 horse-power available for traction. This railroad mounts from the sea level, at Mollendo, to a point on the line at Crucero-Alto, which is at an elevation of 16,000 feet. The length of line is about 220 miles, so that the average grade is thirteen feet in a thousand. The power required to move trains over this line is easily calculable. In fact, with the 4,000 horse-power available, it would be possible to move simultaneously a total weight of 350 tons; that is to say, five trains of seventy tons each, or three trains of 116 tons. This is at a speed of twenty-two miles an hour. At a lower speed correspondingly more or heavier trains could, of course, be run. It never, or rarely, happens on this railroad that this load would exist. In fact, it has been shown that the average train on the road consists of but six cars.

If three-phase traction should be adopted the descending trains, instead of absorbing energy from the line, could operate in a reverse sense and turn back power to the system, the motors being employed as generators.

As to the second question. The maximum distance of transmission will not be more than 210 miles, and this distance could be economically covered by means of apparatus now available. The high-tension line would, of course, be limited merely to supplying substations situated at appropriate points.

As to the third question. The traffic is not at present sufficient to justify the complete transformation of all the railroad apparatus, or at least of the locomotives. For this reason, I advise the adoption of "electrothermic traction," which consists in heating the boilers of the existing steam locomotives electrically. This system of traction has not yet been applied in practice, but it is exceedingly simple in principle, and easy of adoption. It was suggested in 1904, when the question of electrifying the greater part of the steam railways of Switzerland was under consideration, and it was described in detail in the *Revue de l'Electricite*, in its issue of February 15, 1904. The system was not adopted because it was shown that it would not be economical, since the power required for this system is much greater than that for the ordinary system, and the efficiency is less. Switzerland, therefore, preferred to adopt a mixed solution; that is, to continue the use of steam and to introduce electric traction on the same lines. In this way they preserve



REAR VIEW, DISTRIBUTING SWITCHBOARD, CHARCANI CENTRAL STATION.

the existing locomotives, and keep them in service until they are completely worn out. When a new locomotive is necessitated, an electric locomotive is secured. These steam trains are alternated with electric trains fed by overhead lines or by a third rail. In the case under present consideration, the current could be used very well in this way, since the hydroelectric stations are installed mainly for supplying light at night. Moreover, the price of coal is very high. By installing a line and by transforming the present locomotives to electrothermic locomotives, the present work could be done, and all new locomotives could be electrical.

Regarding the fourth question. For reasons which are well known, the voltage of the transmission line should be 60,000 and the current should be three-phase. This current should be transformed for service down to 12,000 volts, which was the potential on the Marienfeld-Zossen experimental line. The simplest and easiest system to adopt for heating the locomotives is that known as the "induction system."

As to the economy of the transformation, which is the fifth question raised above, although the cost of transmission might be high, it would not be very great with the system just suggested, and if, as may be assumed, the hydroelectric station will be installed for other usages, its application for operating the Peruvian railways will bring about a great economy. I do not think that the electrothermic traction system suggested will involve a cost of transformation of more than $2,000 for each locomotive, or $92,000 for the forty-six locomotives at present in service.

The system at present in operation consists of about 450 miles, which, with the branch to Sicuani-Cuyo, will be increased to about 620 miles. In estimating the cost the high tensions suggested for the primary and secondary lines should be remembered, and also that the service can be given by a single-phase supply with a rail return; that the high-tension line need not follow the track, but may run directly from substation to substation, which will effect a considerable saving of copper, and further that the necessary wooden poles may be found along the line.

From these considerations, I conclude that it is not far from the truth to say that the entire transmission and distribution system could be constructed for the sum of $2,000,000, including the transformers. This with the transformation of the locomotives would make the system suggested cost $2,092,000, which, at a rate of ten per cent for depreciation and interest, would make the annual cost $209,200. The actual expense at the present time is not less than $500,000 a year for coal. Moreover, the cost given above could certainly be somewhat reduced. There are also advantages, direct and indirect, which could be secured by the adoption of electricity. An increase in traffic would be possible as the electric locomotives are procured, and when the cost of the change has been completely paid out of the saving, the cost of operation would be reduced to a small sum. This is an important consideration, particularly if compared with what the cost of operation by means of coal would be with the doubled traffic and with the system extended to Sicuani-Cuyo.

Vermont Electrical Association.

The sixth annual meeting of the Vermont Electrical Association was held at St. Albans, Vt., September 18 and 19. The programme included the reading of the following papers: "Sale of Current for Charging Automobiles," Frank J. Stone, Boston; "Rates and Systems of Charging," J. S. Codman, Boston; "Heating," James I. Ayer, Boston; "The Steam Turbine," C. B. Burleigh, Boston; "Co-operative Commercialism in the Electrical Field," J. Robert Crouse, of the Co-operative Electrical Development Association; "Notes of a Layman on Electricity and Its Allied Forces," by Gen. E. L. Bates, of Bennington. V. R. Lansingh, New York city, delivered a lecture on "Modern Illumination," illustrated by lantern slides.

A feature of the meeting was a session of the Vermont section of the Sons of Jove, at which twenty-two candidates were initiated.

On September 19 the members of the association visited the power plant of the Vermont Power and Manufacturing Company at Fairfax Falls. The annual banquet was held in the evening, C. B. Burleigh acting as toastmaster.

The following officers were elected for the ensuing year: president, E. E. Larrabee, of Bennington; first vice-president, F. H. Barker, of Burlington; second vice-president, J. E. Davidson, of Montpelier; secretary and treasurer, C. C. Wells, of Middlebury; executive committee, E. D. Blackwell, of Brandon, C. E. Parker, of Vergennes; F. H. Foote, of St. Albans; Frank Barney, of Bennington.

First Use of Wireless Telegraphy on the Stage.

The following item is from the *Electrician*, London, of September 6:

The first introduction of wireless telegraphy on the stage is to be credited to Mr. Arthur Collins, of Drury Lane Theatre, London, who, in a new play by Messrs. Raleigh and Hamilton, entitled "The Sins of Society," will utilize the wireless telegraph in one of the chief scenes. Wireless telegraphy has very often figured in fiction, but this is the first time, to our knowledge, that it has been presented in a "legitimate" playhouse.

As this seemed to be a rather tardy use of one of the most-talked-about inventions of recent years, some inquiry was made to find out whether wireless telegraphy had not been used on the stage prior to the instance mentioned above. We are informed by Wells Hawks, of Charles Frohman's staff, that wireless telegraphy was first used in this country in Richard Harding Davis's play, "The Dictator," which Mr. Frohman produced February 4, 1904, in New Haven, with Mr. Collier in the principal rôle. The play was taken to the Criterion in New York the following month, about three years before Arthur Collins had used the wireless effect in the Drury Lane Theatre in London.

Dr. Steinmetz's Lectures on Light and Illumination.

The Polytechnic Institute of Brooklyn offers the following interesting course of lectures on radiation, light and illumination by Professor Charles Proteus Steinmetz, of Schenectady. The lectures will be given in the evening and will be illustrated by occasional experiments. The dates and subjects are:

November 7—"Radiation as a Form of Energy. Physical and Chemical Effects of Radiation."

November 21—"Physiological Effects of Radiation; Visible, Infra-Red, Ultra-Violet and X-radiation."

December 12—"Black-Body, Gray-Body and Colored-Body Radiation."

January 9, 1908—"Selective Radiation of Gases and Vapors, Arcs and Discontinuous Discharge."

January 23—"Efficiency of Transformation into Radiant Energy."

February 13—"Measurement of Radiation and Photometry."

February 27—"Commercial Illuminants, Flames, Incandescent Lamps and Arc Lamps."

March 12—"Illumination and Illuminating Engineering."

New York Electrical Show.

Madison Square Garden, New York City, September 30 to October 9.

THE Electrical Show, under the auspices of the Electrical Show, Incorporated, which is being held at Madison Square Garden, New York city, opened on the evening of Monday, September 30 with every prospect of being an unqualified success. This is the first time in a long while that New York has made such a showing electrically. The officers of the Electrical Show, Incorporated, are George F. Parker, president; James C. Young, secretary, and Walter Neumuller, treasurer.

Of course, the feature of the exhibition is the magnificent display of electric lights —carbon-filament, tantalum, tungsten and other metallized and metallic-filament incandescent lamps, Nernst lamps and Cooper Hewitt mercury-vapor lamps, as well as flaming-arc lamps being used in profusion. The ordinary installation in the Garden amounts to 2,800 incandescent lamps. This has been increased by 10,000 additional eight-candle-power units, and in the large roof signs on the Madison Square Garden tower some 2,000 more are used.

The feature exhibits of the show are those of the Edison Electric Illuminating Company of Brooklyn, the New York Edison Company, the United Electric Light and Power Company, the National Electric Lamp Association, Roger Williams's "Simplex" electric heating and cooking apparatus, the Consolidated Telegraph and Electrical Subway Company, the General Electric Company, the Westinghouse companies, the India Rubber and Gutta Percha Insulating Company, and the New York and New York & New Jersey Telephone companies.

The F. Alexander Electrical Company, 75 Fulton street, New York city, is exhibiting its three-ampere miniature arc lamp. This lamp is used in competition with incandescent lamps and small-sized arcs. The three-ampere miniature arc is said to give 500 actual candle-power, and consumes 330 watts. The company is represented by F. Alexander.

The Consolidated Telegraph and Electrical Subway Company, 52 Duane street, New York city, shows an elaborate exhibit of a full-sized brick and concrete manhole, demonstrating the method of running cables in single and multiple duct. These include cables for light and power, telephone and telegraph service. The manhole is built from the floor up, so that the visitors may enter and see the method of supporting the cables on the cable racks within the manhole.

The Driver-Harris Wire Company, Harrison, N J., is showing applications of Driver-Harris resistance wire as applied to locomotive headlights with resistances attached, car heaters, electrical measuring instruments, arc lamps, heating and cooking utensils for household use, rheostats, theatre dimmers and motor starters. This company is represented by Arlington Bensel and Wilmot H. Kissam.

The Federal Sign System Company, New York city, representing the Federal Electric Company, Chicago, Ill., is showing its various types of signs These include porcelain enameled steel unit letters and interchangeable panel signs. There are also samples of the large cut-out letters for roof-sign work The company is represented by H. E. Brinckerhoff, manager of the New York office, and W. W. Tower.

The General Electric Company, Schenectady, N. Y., is making a fine showing of electric radiators, domestic irons, motor-operated sewing machines, washing machines, motor-driven music boxes, the Halliwell hair-drier, coffee grinder, meat chopper, dough mixer, ice-cream freezer, potato peeler, carpet renovator, flame-arc lamps, mercury-arc rectifier and charging panel, forge blower, Ingersoll-Temple electric rock drill, Kantner mitre saw, Coates clipper drill, Bridgeport safety emery wheel, tungsten, tantalum and metallized-filament incandescent lamps, a direct-connected, four-cylinder gasolene engine and generator, and a train-lighting steam turbine. The company's guests are looked after by a host of representatives, and demonstrations of various apparatus are made continuously.

A feature of the General Electric exhibit is a series of booths in which are suspended various types of illuminants, showing the advantage of the open arc with a concentrated Holophane reflector for matching-up textiles. This arrangement is surmounted by a talking sign supplied by the Electric Motor and Equipment Company, and is attracting a great deal of attention.

A. Grothwell, 136 Liberty street, New York city, is exhibiting the "Mogul" paints, electrical compound, armature varnish, acid and alkali-proof compound, and paints and varnishes for power-house applications.

The India Rubber and Gutta Percha Insulating Company, 253 Broadway, New York city, shows a full line of Habirshaw wires, cables and cores and material for high-tension transmission and for underground and submarine service. This company is represented by J. B. Olson, general sales manager; R. S. Satterlee and Harry Stevens.

The National Electric Lamp Association, Cleveland, Ohio, is making its characteristic exhibit of incandescent lamps, arranged so as to present a splendid display, showing both the practical and decorative values of these light units. The exhibit includes tantalum, tungsten and metallized-filament lamps arranged with Holophane reflectors of both the concentrating and diffusing types. In addition to the display of miniature lamps there is an added feature showing tungsten forty, eighty and 100-watt lamps burning horizontally. The companies represented by the National Electric Lamp Association are the Banner Electric Company, Youngstown, Ohio; Brilliant Electric Company, Cleveland, Ohio; Bryan-Marsh Company, Chicago, Ill.; Buckeye Electric Company, Cleveland, Ohio; Colonial Electric Company, Warren, Ohio; Columbia Incandescent Lamp Company, St. Louis, Mo.; Economical Electric Lamp Company, New York city; Fostoria Incandescent Lamp Company, Fostoria, Ohio; General Incandescent Lamp Company, Cleveland, Ohio; New York & Ohio Company, Warren, Ohio; Shelby Electric Company, Shelby, Ohio; Standard Electrical Manufacturing Company, Niles, Ohio; Sterling Electrical Manufacturing Company, Warren, Ohio; Sunbeam Incandescent Lamp Company, Chicago; Warren Electric and Specialty Company, Warren, Ohio, and the Sunbeam Incandescent Lamp Company of Canada, Limited.

Among the representatives and visitors in attendance at the booth of the National Electric Lamp Association are the following: J. C. Fish, president of the association; S. E. Doane, chief engineer; A. S. Terry, manager of the Sunbeam Incandescent Lamp Company; Colonel E. E. Nash, manager of the Warren Electric and Specialty Company; N. L. Norris, manager Banner Electric Company; George G. Lockwood, manager Bryan-Marsh Company; L. P. Sawyer and J. R. Hunter, Buckeye Electric Company; V. R. Lansingh, H. M. Lauritzen and C. A. Howe, of the Holophane Company; E. J. Kulas, manager Brilliant Electric Company; L. Lobenthal, manager Economical Electric Lamp Company; Messrs. Dolan, Spaulding and Porter, of the Sunbeam Incandescent Lamp Company and W. M. Skiff and George Loring, of the engineering department of the National Electric Lamp Association.

The Metropolitan Engineering Company, 120 West Forty-second street, New York city, is exhibiting its various types of signs, including panel signs, roof signs, overhanging signs and sign fixtures. This company built the big Brooklyn Edison sign, which is 100 feet long by twelve feet high, with 966 eight-candle-power lamps, displayed across the entire rear wall of the Garden. The United Electric Light and Power Company's inside sign, thirty-two feet long, containing 700 lamps; and its large sign on the Madison Square Garden tower, fifty-three feet long with four-foot letters, contain-

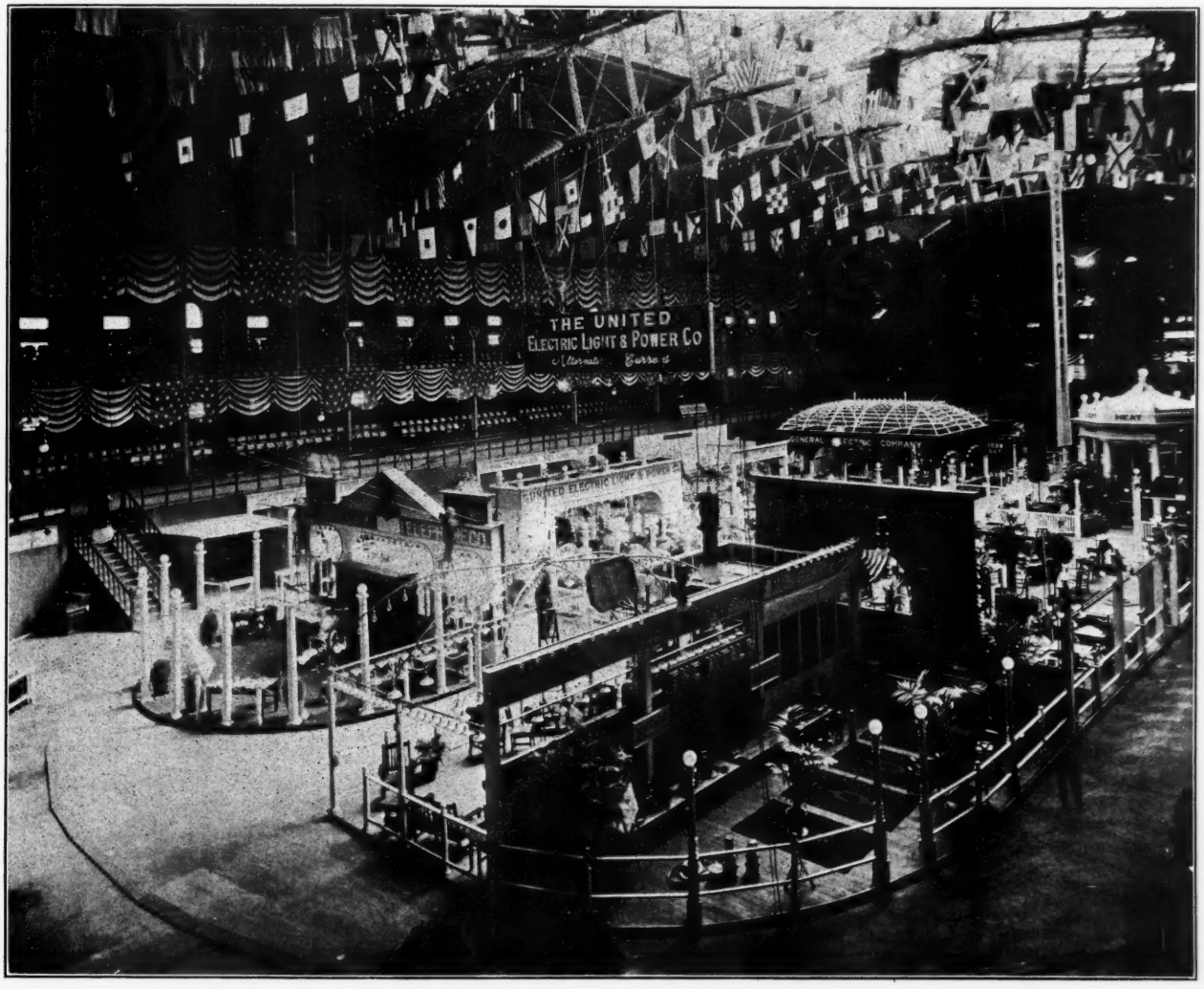
ing 2,000 eight-candle-power lamps, were also built by the Metropolitan company. The company is represented by Benjamin Wall and J. E. Peters, sales manager.

The Garvin Machine Company, Spring and Varick streets, New York city, is making a fine exhibit of motor-driven machine tools, including a universal milling machine operated by a three-horse-power variable-speed motor; two plain milling machines, both operated by three-horse-power variable-speed motors. One of these motors is shown in operation cutting up blocks of cast iron. There is also a No. 13½ plain milling machine with an automatic slot-milling attachment. This is driven by a one-and-one-half-horse-power variable-speed motor, and is the first time the tool has been shown. There is a three-and-one-half-foot Hamilton radial drill operated by a constant-speed three-horse-power motor; an automatic tapping machine driven by a one-horse-power variable-speed motor, and a die-slotting machine driven by a one-horse-power constant-speed motor. The motors shown on these machine tools are of the General Electric CQ type, although the machines are regularly made for operation by any make of motor. The company is represented by G. J. Thompson, sales manager.

The exhibit of the Westinghouse companies occupies a space of about 2,000 square feet. Approximately twenty applications of electric motors are shown, including ironing machines for the home and for laundries; pipe-threading machinery, showing the most compact arrangement with this sort of work that has yet been made possible, the same being operated by means of a motor, rheostat, switches and wiring all on one bed; a blower for ventilating mines, subways, etc.; vacuum cleaner, made by the Sanitary Devices Manufacturing Company, for the renovation of houses, hotels, etc.; exhaust fan made by the American Blower Company, for ventilating purposes; the Watson-Stillman pump for the raising of water to small house tanks for summer residences, hotels, etc.; a rotary air-compressor for the operation of compressed air, tools, inflation of automobile tires, etc.; Yale & Towne hoist for factory uses; dish-washing machinery for the cleaning of dishes in the home and in hotels and restaurants; Singer sewing machine for domestic purposes; textile loom, which is being operated to show the manner in which fabrics are woven; dough mixer, showing the manner of mixing dough in the home and in bakeries; and last, but perhaps most interesting to the commercial man, is the phonograph in conjunction with the record shaver. All of this apparatus is driven by Westinghouse motors, and in attendance with each exhibit is an expert who explains the operation of the machinery.

In the same space the Westinghouse Lamp Company, to the edification of visitors, shows the different processes through which an electric lamp passes before it is ready for use as an instrument for illumination.

The Westinghouse Electric and Manufacturing Company shows a full line of arc lamps for all currents and voltages, as well as a complete list of measuring



MADISON SQUARE GARDEN. LOOKING EAST, NEW YORK ELECTRICAL SHOW, SEPTEMBER 30 TO OCTOBER 9.

instruments. Fan motors for all circuits are shown and transformers of various types and sizes.

The space is attractively lighted with Nernst lamps mounted on columns. Cooper Hewitt mercury vapor lamps are also exhibited from the ceiling of Madison Square Garden, demonstrating the value of this lamp for the lighting of large areas, such as shops, factories, train sheds, wharfs, etc.

The Westinghouse Machine Company shows storage batteries for central station work and also sparking batteries for automobiles.

A fifteen-horse-power type SA motor is shown in the exhibit, operating under load on a 220-volt, direct-current circuit, and attached to this machine is a speed-indicating device.

The Westinghouse companies are represented as follows: W. C. Webster, manager New York office Westinghouse Electric and Manufacturing Company; W. S. Rugg, P. T. Brady, F. H. Shepard, C. F. Street, O. S. Smith, W. L. Conwell, W. Nesbitt, D. E. Drake, Seth Adams, G. Hersey, C. C. Owens, O. A. Millhaulen, A. O. Miller, S. C. Chase, W. H. McGregor, H. Clegg, P. B. Warner, P. Hallenbach, A. Perry, G. DuBarry, W. C. Ward, H. S. Fisher, H. A. Pratt, L. H. Haight, G. H. Wildman, C. C. Bawden, M. Coster, D. Mills, L. Goldsmith, C. Marriott, G. Massey, L. Martin; J. C. McQuiston, manager Westinghouse Companies' Publishing Department; C. B. Humphrey, manager Westinghouse Lamp Company; E. W. Ayre, T. W. Whaling, H. W. Jackson, H. V. Jones; L. L. Brinsmade, manager Westinghouse Machine Company; W. H. Davis; H. L. Barton, manager Nernst Lamp Company; J. B. Hill, manager Cooper Hewitt Electric Company, and A. D. Childs.

The Edison Electric Illuminating Company of Brooklyn is making one of the most elaborate and pretentious exhibitions ever seen in an electrical show. The exhibit proper comprises a complete apartment, including laundry, kitchen, dining room, reception room, parlor, bedroom, staircase, library and an extra room for the display of fixtures and the registration of guests. In the kitchen there is an electrically driven washing machine, a domestic refrigerating system manufactured by the Brunswick Refrigerating Company, New Brunswick, N. J., a thirty-gallon hot-water boiler made by the Simplex Electric Heating Company, a vacuum carpet-cleaning system, a Simplex electric range, and numerous kitchen accessories for the elimination of dust and dirt and the economizing of household work. The other rooms are fitted up with every device which has been produced by the manufacturers for the comfort and luxury of the home. The illumination was planned by V. R. Lansingh, of the Holophane Company, and the furnishings were, for the most part, supplied by Abraham & Straus, of Brooklyn. A good idea of the extent of this exhibit may be gained from a list of the manufacturers whose apparatus is shown: house furnishings and decorations, Abraham & Straus; heating and cooking appliances, Roger Williams (Simplex) and General Electric Company; electric fixtures, Robert Findlay Manufacturing Company, Brooklyn; globes, reflectors and shades, Holophane Company, New York city; refrigerating and ice-making machinery, Brunswick Refrigerating Company, New Brunswick, N. J.; motors for refrigerating, dish-washer and coffee grinder, Robbins & Myers Company, Springfield, Ohio; vacuum cleaner, Hygienic Cleaner Company, New York city; "1900" washing machine, "1900" Washing Machine Company, Binghamton, N. Y.; Telharmonic music, Eastern Cahill Telharmonic Company, New York city; electric piano, the Telelectric piano player, New York city; sewing machine and motor, Singer Sewing Machine Company, New York city; telephones, New York Telephone Company, New York city; kitchen sink and boiler, Burr Manufacturing and Supply Company, Brooklyn; dish-washing machine, G. S. Blakeslee & Company, New York city; Victor "Auxelophone," Jacot Music Box Company, New York city; buffing motor, Emerson Electric Manufacturing Company, St. Louis, Mo.; buffing lathe, W. Green Electric Company, New York city; show-case and oil-painting reflectors, Charles W. Leveridge, New York city; Almond "Flexo" desk lamps, T. R. Almond Manufacturing Company, Brooklyn; water filter, George M. Kneuper, Brooklyn.

The Edison company is making up a card register of all the visitors to its exhibit, and after the registration is complete, these cards will be assembled and fifty will be drawn, and the registrants on the first fifty will be awarded valuable prizes. These prizes include the wiring of three residences, the wiring of five stores and other prizes ranging from a single heating or cooking device to a complete kitchen set.

The Electrical Testing Laboratories, New York city, is exhibiting its precision instruments, balancers and checking apparatus, and has equipped a photometer room, where a working photometer is in operation, together with an oscillograph and stroboscope. The company is making tests of meters and checking lamps free during the exhibition. It is ably represented by Wilson S. Howell, Dr. Clayton H. Sharp, Preston S. Millar and A. D. Farmer.

G. M. Gest, New York city, is showing typical views of conduit installations and single and multiple duct. The Gest cable rack is also on exhibition. In this company's booth the H. B. Camp Company is showing its single and multiple duct, and the conduit manufactured by the Fibre Conduit Company, Orangeburg, N. Y., is also exhibited in sections and full lengths, in both the untreated and treated condition. The company is represented by G. M. Gest and H. H. Stannard.

The Advertising Mirrorgraph Company, Brooklyn, N. Y., is showing its flashers and "Thermoblinks," mirror signs, advertising signs and single-lamp letters. William Kelley is in charge of the exhibit.

The Kenney Electric Manufacturing Company, New York city, is showing numerous electrical applications, including a printing press, the motor taking its current from a lamp socket. This press is operated with a variable-speed motor, and can be stopped instantly by the movement of the foot treadle without working on the rheostat. The Kenney system of friction drive is also shown in operation. The exhibit includes a motor-driven drill press, circular saw and a power hack saw. The company is represented by Paul T. Kenney.

The Monaton Construction Company, Brooklyn, N. Y., is showing engineering plans and receiving its visitors in a neat reception room. The company is represented by E. W. Phillips.

The New York Edison Company has a very attractive exhibit in the centre of the main hall. This is in the form of a colonnaded pergola, and is very attractively decorated with tantalum lamps. In addition to a very cozy reception room, there are numerous applications of electrical devices, including dough mixers, ice-cream freezers, coffee mills, printing presses, cigar lighters, vacuum cleaner, lathes, show-window lighting, buffing machines, the electric drill manufactured by the Chicago Pneumatic Tool Company, and a hoist manufactured by the same company, letter-copying machine, three-ton electric truck, hair-drying machine, hair curler, meat chopper, portables, fixtures, floor-finishing machines, telautograph, massage apparatus, buffers and blowers. The company made a hit distributing a souvenir scarf-pin embodying the symbolic little man of the Edison light brigade.

The New York Telephone Company is making a very interesting exhibit just to the left of the main entrance to the exhibition hall. Five sound-proof booths have been fitted up for long-distance service, and a double monitor express switchboard is being operated for the benefit of the exhibitors, a telephone being placed in each booth. In conjunction with the New York Telephone Company, the New York & New Jersey Telephone Company and the American Telephone and Telegraph Company are making headquarters at the Garden. The American Telephone and Telegraph Company is represented by those two well-known old-timers, Henry B. Lytle, of the contract department, and William Hood, special agent of the contract department. The New York Telephone Company is represented by the affable H. K. McCann, chief of the contract department, ably assisted by Oscar Graham.

The Safety Car Heating and Lighting Company, New York city, is making an elaborate exhibit of an axle-driven car-lighting system mounted on a full-sized six-wheel truck. This is the style of

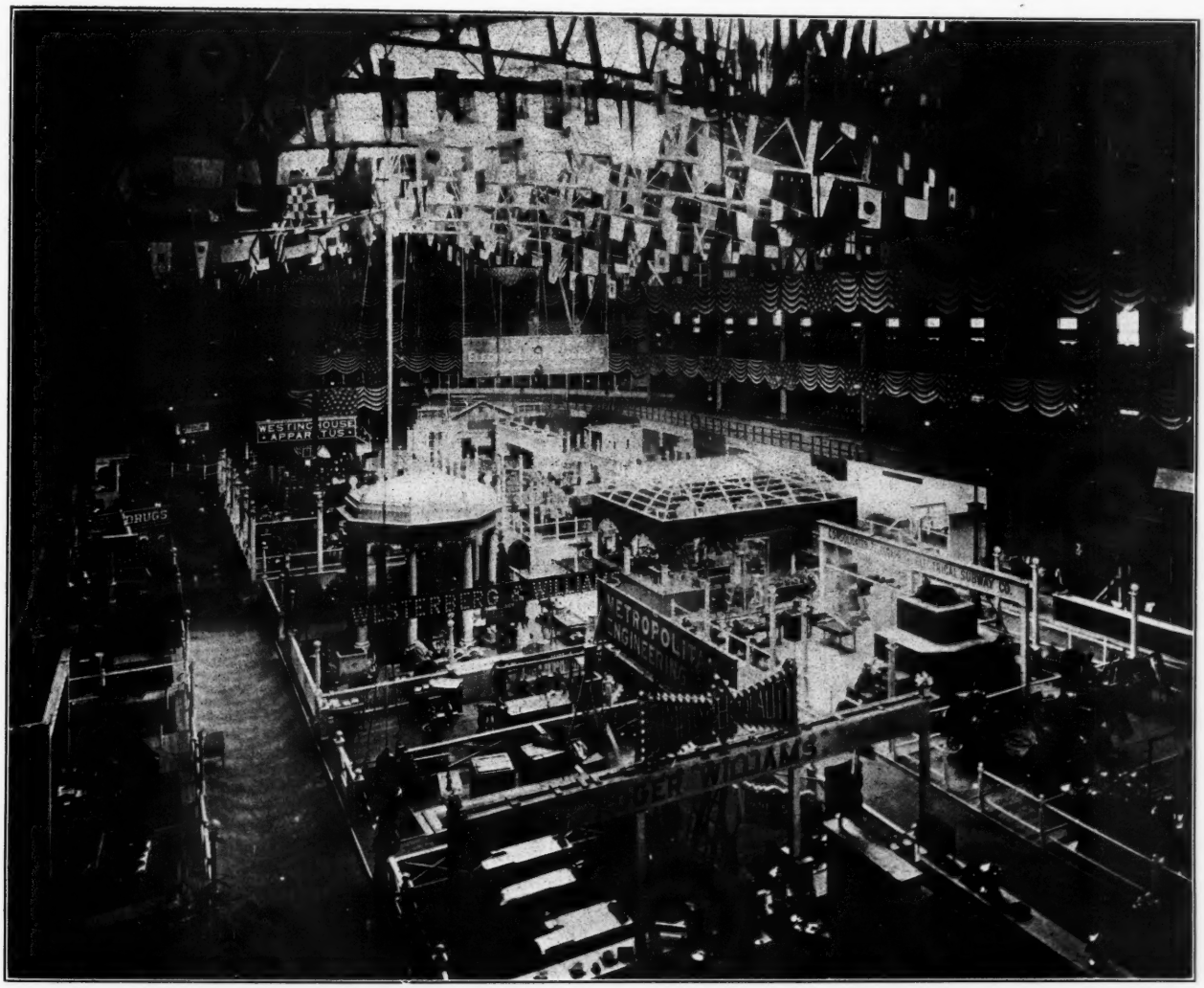
equipment supplying light for the Pullman cars throughout the country. The generator has a capacity of eighty amperes at fifty volts. The complete system is shown, including the regulating apparatus and connections. In addition to the axle-lighting system the company shows various fixtures which are employed in lighting and heating train equipments. The company is represented by H. G. Thompson, superintendent of the electrical department, and W. I. Thompson, superintendent of tests.

The Standard Roller Bearing Company, Philadelphia, Pa., is making a very interesting exhibit of all types of its roller bearing. This booth attracts a great deal of attention.

The American Wire Brush Company, New York city, is showing the "Minerva" wire brush for cleaning boilers, flues, conduits, chimneys, structural surfaces, sewer pipes and car tracks. The company is represented by H. R. Ravens and F. Polk.

Roger Williams, New York city, representative of the Simplex Electric Heating Company, is making one of the most elaborate exhibits of electrical heating and cooking devices ever shown. Mr. Williams has assisting him a corps of attractive and intelligent women, who are kept busy explaining the workings of these devices. One of the features of this exhibit which is attracting a great deal of attention is the new form of Simplex range. This does away with the angle-iron frame and the slate back-board for the connections. The oven is strongly constructed with an iron framework, and is made to serve as the base for the top of the stove. All of the connections come up through the face plate above the oven, and there are absolutely no cord circuits to get in the way or become spattered with grease from the cooking. The connections are all controlled from four-way snap switches located on a slate base in front of the range. Another feature which facilitates heating and cooking is the patented method of clamping the cooking utensil tightly against the heating surface. This improves the conduction of heat, cuts down the consumption of current, and also economizes the time the apparatus is in service.

The American Marconi Wireless Telegraph Company established two stations, one at each end of the Garden, and demonstrates continuously to an interested throng the methods of sending and receiving the wireless messages. Regular business is handled at the Garden, and a genuine ship-reporting station is established, keeping a record of the incoming transatlantic steamships. The stations in use average only about half a kilowatt in capacity, but these, it is stated, have a range of 300 miles. The magnetic form of detector is in use, and a new feature which is being employed has to do with the ability of the operator to break in on a message at any point. His receiver is connected directly in the circuit with the transmitter, and by pressing down the heel of the key, he can break in on a message and send back to the sending station, his receiver being cut out and his reception of the message not interfered with by his own sending.



MADISON SQUARE GARDEN, LOOKING WEST, NEW YORK ELECTRICAL SHOW, SEPTEMBER 30 TO OCTOBER 9.

The National Dairy Supply Company, 32 Park Place, New York city, is demonstrating the Burrell-Lawrence-Kennedy cow-milker. Four cows supplied by Albert Schimmel, of Flushing avenue, Maspeth, N. Y. city, are on exhibition, and a curious and interested crowd always gathers about this booth. The apparatus operates on the suction principle, the machines being operated by a partial vacuum. The device is sanitary and is said to give absolute satisfaction.

The Beck Flaming Lamp Company, New York city, is making a fine display of its flaming arcs, which are rated at 3,000 nominal candle-power. The twelve big lamps installed on the outside of the Garden give a fine idea of the illuminating values of this form of lamp for outside work. Within the Garden six of the lamps are strung along the north side of the arena. In its booth the company is demonstrating a complete line of Beck lamps, including series and multiple alternating-current, and series and multiple direct-current lamps. The H. C. K. Company is also showing a full line of portables and fixtures, demonstrating the effects of these fixtures in a shadow box in this booth. J. H. Hallberg, William Ottmann, H. B. Coles, W. J. Bramhall, R. M. Schmid and Messrs. Gauché, Berkowitz and Poor are in attendance.

The Excello Arc Lamp Company, New York city, is drawing attention to its Excello flaming-arc lamps with a fine installation of six seventeen-hour "Sun Ray" lamps strung along the south side of the arena. In the tower of Madison Square Garden four lamps of the same type are suspended 200 feet above the sidewalk. These are attracting a great deal of attention. In the booth of the United Electric Light and Power Company there are two standard "Sun Ray" lamps operating on alternating current. In the booth of the Driver-Harris Wire Company there are two "Pearl White" Excello flaming arcs. In the Excello company's booth there are being demonstrated several types of the company's standard lamp, showing the method of operating and the mechanism in detail. In addition to the mechanical apparatus there is a very neat display of views showing typical installations of Excello flaming arcs at home and abroad, distribution curves of the lamp, and sectional and descriptive drawings of the details of assembly. H. M. Hirschberg, president, and Otto Baerwinkel, secretary and manager, are in attendance.

The W. Green Electric Company, New York city, is showing a very interesting line of small tools for dentists, household and light manufacturing use. These are operating from incandescent-lamp socket attachments. There is shown a polishing and grinding machine with a double-ended connection. There is also an interesting alternating-current machine with a friction drive, the principal feature of which is the automatic oiling arrangement. A special watchmaker's lathe is attracting a good deal of attention. One of the features of this exhibit is the Westminster electric chimes. This company is represented by A. Rosenberg.

The United Electric Light and Power Company is exploiting the use of alternating current for manufacturers and household use from the street mains. It is indeed interesting to see the wide range of applications of alternating-current apparatus. Some of the most beautiful effects in portables and electrical display apparatus, to say nothing of arc and incandescent lamps, are shown at this booth. An interesting feature is the installation of Richmond and "Century" alternating-current motors driving pumping apparatus.

The Morlite Company, New York city, is demonstrating the "Just" tungsten lamp.

Westerberg & Williams, engineering contractors, New York city, are demonstrating several very interesting applications of the motor drive. These include a refrigerating plant on the ammonia-compression system, producing 800 pounds of ice per day. A large refrigerator is being cooled, and also drinking water for the visitors and attendants. In connection with the ice plant, the New York Continental Jewel Filter Company's apparatus is being used to filter the water. The refrigerating apparatus is driven by a Westinghouse two-horse-power type S direct-current motor. Other adaptations of the electric drive are a centrifugal and a vertical pump manufactured by the Gould Manufacturing Company, the centrifugal pump being controlled by a float switch. Another application is an ice-cream freezer driven by a one-and-three-quarter-horse-power type R Westinghouse motor.

The Amboy Works, Perth Amboy, N. J., is making a very beautiful display of art-glass domes and shades. The designs for these devices are made up specially, and include some of the most elaborate treatment which this subject has ever received. The bronze work used in connection with these devices is particularly unique, and the exhibit is attracting a great amount of attention from fastidious observers. The company is being represented by O. M. Dixon.

An electric automobile lent by the Baker Motor Vehicle Company, New York city, demonstrates the charging of the electric batteries from the Edison mains. The batteries are Exide No. 9 MV type, driving a two-and-one-half-horse-power motor. A battery of the character exhibited has a range of sixty to seventy-five miles on a single charge. On a recent test this battery made 101.6 miles, and the running included some rather heavy weather. The representative in charge is R. N. Clyde.

F. W. Fenn, manufacturer of electrical novelties, is displaying electric novelties in the form of electric light scarf pins, flashers and bull's-eyes. Miss R. V. Finn, is in attendance.

Among those present were the following: John W. Lieb, Jr., and Arthur Williams, New York Edison Company; Dudley Farrand, Public Service Corporation of New Jersey; H. B. Kirkland, National Metal Molding Company; W. W. Freeman and M. S. Seelman, Jr., Edison Electric Illuminating Company of Brooklyn; F. B. Rae, Jr., C. W. Lee Company; Cyril Nast, New York Edison Company; F. H. Gale, General Electric Company; Wilbur Driver, Driver-Harris Wire Company; Percy H. Ingalls, Public Service Corporation of New Jersey; Edward F. Peck, Schenectady Railway Company; C. Loomis Allen, Utica & Mohawk Valley Railway Company; J. M. Nelson, Jr., and F. A. Curtis, Fibre Conduit Company, Orangeburg, N. Y.

JOINT MEETING OF THE EMPIRE STATE GAS AND ELECTRIC ASSOCIATION AND THE STREET RAILWAY ASSOCIATION OF THE STATE OF NEW YORK.

NEW YORK CITY, OCTOBER 1.

A very interesting joint meeting and reception was held under the auspices of the Street Railway Association of the State of New York and the Empire State Gas and Electric Association in the concert hall of Madison Square Garden, New York city, on the evening of October 1.

The meeting was opened by T. W. Wilson, president of the Street Railway Association. Mr. Wilson introduced the Hon. Frank W. Stevens, chairman of the Public Service Commission of the Second District, State of New York, who spoke on the subject, "The Work of the Public Service Commission, Second District, and Its Policies with Relation to the Corporations Under Its Supervision."

Mr. Stevens said that his remarks must not be taken as indicating the opinion of the commission as a whole; they must be understood to indicate his personal opinions, although he understood himself that he was requested to address the meeting because of the official position he had the honor to hold in connection with the Public Service Commission.

One of the most important matters in connection with the Public Service Commission and the corporations over which it was given such wide powers was the attitude which the commission and the corporations should bear to each other. No man should serve on this commission who did not subject himself to a self-analysis and who had not thoroughly made up his mind to deal honestly, fairly and fearlessly, as any attempt to work to the disadvantage or lessen the usefulness of the public service corporations would not only be working an injury to the corporations, but would also be violating the public trust.

One of the principal works of the com-

mission is the investigation of accidents. Too much emphasis can not be laid upon this matter. Human life has been regarded too lightly altogether by the railroad corporations of the country. There has been, in his mind, an unnecessary slaughter, and means should be taken to discover the reasons for this and for the application of the proper remedies. Of course, in many instances injury and death have resulted from the negligence of the victim or through the negligence of the employé of the corporation. Be this as it may, it is a terrible penalty that any one should lose his life because of momentary negligence, and the corporation should see to it that every safeguard is put about the passenger and that every effort is made to secure that kind of employé who will make for this safeguarding.

Another part of the work of the commission is the investigating of the finances of the corporations and the giving of permission for the circulation of new issues of stocks and bonds. The power of unlimited capitalization should be restricted, and the corporations must procure straight and honest capitalization.

Still another question is, what is the commission going to do about those things which have excited public discontent and indignation? Is this public discontent a mere wave of passion sweeping over the country without cause? In Mr. Stevens's mind there has been and is a reason for this discontent. The steam railroads, he contends, have not been doing their duty by the people. Possibly this has been due to lack of organization and lack of ability to keep up with the demands, but the cause should be found out, and where it is a matter of mismanagement the weaklings should be weeded out and strong men put in their places. It is not an easy matter to discover what the causes of this trouble are. Testimony and evidence must be sifted down to the last analysis. Mr. Stevens cited the case of Buffalo. In Buffalo the merchants believe that they are discriminated against, and upon taking testimony in that city, Mr. Stevens believed the conditions were bad. However, upon going down to Wayne county, the merchants there complained that Buffalo got everything it wanted in the way of service, and was taking all the cars away from Wayne county. Going to Oswego, Mr. Stevens was impressed with the idea that Buffalo was the most favored city in the world as regards transportation facilities. Nevertheless, it was a fact that both passenger and freight service on the steam railroads was in a bad condition, and one of the first duties of the commission will be to seek the cooperation of the corporations involved and produce as speedily as possible the remedies necessary. People should pay liberally for good service, but they will not pay for poor service. Freight should be moved rapidly, and the passengers upon the railroad should not suffer great economic losses of time because of delayed schedules.

The next speaker was Henry J. Pierce, president of the International Railway Company, Buffalo, N. Y., who addressed the meeting on the subject of "The Electric Railway Situation of To-Day."

Mr. Pierce, as a preliminary, addressed Mr. Stevens, and said that after hearing what he had to say, it surely looked as though the Public Service Commission was on to the corporation's curves, and that the corporations would have to watch out; but, he said, it is well for the corporations, it is well for the people if, when those high in authority speak, it is remembered that the majority of the corporations are conducting their business as legitimate enterprises, and that they should not be condemned for the failures and for the malefactions of a few. Mr. Pierce compared the latter-day installations on electric trolley lines with the installations of quite recent date. The great strides which have been made in the development of the electric railway, and the demands for new equipment and more expensive maintenance could not be met out of the earnings; hence the issues of stocks and bonds. If the trolley corporations were overcapitalized, it was a necessary evil, and if it were not for the water in the stocks, the people would have to wait for a large part of the improvement they are now enjoying. The public service corporation must give to the public good service, and should return to its stockholders a fair dividend on their investment. The companies must give better service all the time and keep on improving their plants, but they must not charge higher rates. In spite of this limitation, however, labor and the cost of material have been increased some forty per cent. The manufacturer can close down his plant or slacken up if business falls off, but the public service corporation must run to the limit of its schedule. Real estate can be purchased for a fixed sum and left neglected for years, but the public demands the best that the public service corporation can supply. No good man nor any good corporation wants lower wages. Lack of money often means lack of the necessities of life, and the corporation that attempts the lowering of the wage scale is indirectly lowering its own prospect of reward. Lower prices for manufactured products mean lower wages for the artisans employed; higher fares make riding a luxury; and neither of these resorts will meet the situation. The public sometimes unwittingly harasses the street railway corporation more than any other public utility, and the municipalities favor the public in this respect. At the same time, no other public service has so benefitted the public and so increased the value of the municipality and the commonwealth, and for this reason alone the burden of taxation should be lightened. Here lies the real solution of the difficulty.

When the Public Service act was first considered, Mr. Pierce objected to it because, first, it placed in the hands of a few men a power which he deemed extraordinary; and then again, it made those who held in trust the investment of large bodies of people liable to the jurisdiction of a commission, and did not give them recourse to a fair trial by jury which is the right of every citizen of any standing. He was happy in his belief, however, that the choice of the commission, as exercised by the governor, was a good one, because he felt that every man on the commission was an honest gentleman and would give an opinion according to the weight of the evidence produced. This has not always been the case. He hoped that his brethren in the Street Railway Association and in the Empire State Gas and Electric Association would adopt the same attitude toward the commission and toward the law that he and his company would. So long as the law has been enacted and is placed on the statute books, he would observe it. He would cooperate in every way with the commission to work to the best advantage of all concerned. He felt sure that the commission would discover that the taxation was burdensome; that the public service corporations are not any more overcapitalized than is real estate overcapitalized. Capital is entitled to a fair return, no matter where invested, and he felt sure that he made no mistake in saying that eighty per cent of the street railway companies of the country were not paying dividends. When the matter had been thoroughly investigated it would be discovered that the people were getting a very fair value for the money they spent, and as between the corporation and the people, the people had decidedly the best of it. There was not much chance nowadays for the cor-

porations to get much out of it, hedged in as they are and dependent as they are upon their father, the state; their mother, the municipality; their guardian, the Public Service Commission, and their uncle, the money lender. Railways are entitled to help, and should not be subject to hindrance. The existing systems are beset by burdensome taxation. Reduction of this taxation is necessary for the continuance of the splendid service which is now being attempted. In towns throughout the country the trolleys are eagerly sought for, but the trouble is that the people too soon forget to appreciate the effort and the convenience placed at their disposal by men who have had the courage to find the money and make an investment in what was really an experimental industry.

The next speaker was Dr. Alexander C. Humphreys, president of Stevens Institute of Technology, who spoke on the subject, "Control of Gas Companies by State Commissions."

Dr. Humphreys contended that President Roosevelt in his attitude for radical reform had done an immense amount of good, and in so doing had brought about an immense amount of harm. It must be the task of history to strike a balance and see whether it rests upon the side of harm or good. There are indications that the tide has commenced to turn, and if these indications are verified, we may well expect to find politicians preparing to desert reform. The gas companies of the state of New York, for some time at least, must be prepared to accept a certain measure of control. Unquestionably, it is better to be subjected to the control of a limited number of honest and capable men who can, from time to time, add to their knowledge and so be better prepared to render a fair judgment on problems more or less intricate.

The closing address of the evening was made by Everett W. Burdett, chairman of the Committee on Public Policy of the National Electric Light Association. Mr. Burdett spoke on the subject, "Public Control from the Corporate Standpoint." His address was in part as follows:

"A statement of the attitude of the public service corporations of the United States toward public regulation and control naturally and perhaps necessarily divides itself into three parts:

"First—What that attitude has been;

"Second—What it is now; and

"Third—What in the future it ought to be.

"The past, present and future attitudes of public service companies toward public control are not, in my view, very much alike. There has, I think, in recent years been a decided change in the attitude of the corporations toward this subject, and I look for a still more radical change hereafter.

"What shall the future attitude of the corporations be toward public supervision and control? In my opinion it should be a friendly and not a hostile attitude. The settling of the questions which will arise before the commissions will involve great principles of law and of public policy alike of interest to the community and of vital importance to the companies. All fears of adverse results are dissipated if one entertains the conviction as I have no doubt the body of the commissioners do that the true interests of both the corporations and the public are substantially the same; that the necessity for injustice to either in order that justice may be done to the other does not exist. It is not for the interest of the public that the corporations shall be crippled in their activities or unreasonably limited in their profits; and, on the other hand, it is not in the interests of the corporations that the public shall be subjected to exorbitant rates, poor service or contemptuous treatment. Time does not permit, and perhaps this would not be the proper occasion, to undertake to develop and demonstrate the truth of these general propositions, but reliance may well be put upon the fact, which I think can not be successfully disputed, that both in this country and abroad the public is best served where the corporations are most prosperous, and the corporations are most prosperous where the public is best served.

"Differences of a serious nature will certainly arise; displays of short-sighted selfishness on the one side and of obnoxious officialism on the other may occasionally obscure issues and perhaps strain personal relations; conflicts of opinion on questions of law, policy and practice will inevitably occur; at times the strain will be severe on all concerned. But all these things are but necessary incidents to the development of the principles which must be established for the good of all. If conducted in the right spirit and with an honest purpose, these conflicts of ideas will result to the common advantage. The main thing is that they be conducted without acrimony and in a spirit of harmonious cooperation; not like gladiators seeking to kill each other, but rather like friendly rivals in a common cause. Such a spirit I believe to be not only essential to the interests of the companies and to the success of the commissions in the administration of the law, but, greater than either, to the general welfare of the public at large, without which neither corporations nor officials nor private individuals can enjoy that full measure of happiness and prosperity which they seek."

At the close of Mr. Burdett's address, C. Loomis Allen moved that a resolution of thanks be entered upon the minutes of the Street Railway Association addressed to the speakers of the evening.

A letter of regret was received from W. R. Willcox, chairman of the Public Service Commission, First District, regretting his inability to be present.

Following this, the meeting was declared adjourned by President Wilson.

On Wednesday morning the Empire State Gas and Electric Association held a meeting at the Edison Auditorium, 44 West Twenty-seventh street. Reports of the officers and executive committee were read. The special committees on public utilities, accounting and insurance also reported, followed by a report on the publicity work of the association.

In the afternoon papers were read as follows:

"Gas Standards," by A. E. Forstall.

"The Meter-Testing Situation and Report of Meter Committee," by R. M. Searle.

"Franchise Taxation," by L. C. Palmer.

"The Agitation for Underground Distribution in Place of Overhead," by W. W. Cole.

"Buying Light," by E. L. Elliott.

"Municipal Ownership in New York State," by Glenn Marston.

Mr. Forstall described briefly the conditions met with in gas service in the borough of Manhattan, and pointed out the necessity of allowing a safe margin of pressure at the gas works to compensate for the loss in friction of main and supply pipes and at the consumers' meters. Mr. Searle dwelt upon the efforts made by the committee to secure data from the member companies, and reported progress. Mr. Palmer made a plea for radical and uniform action by the member companies looking to the elimination of franchise taxation. Mr. Cole gave some interesting data concerning the relative costs of underground and overhead construction, and was of the opinion that the former was four times greater, thus necessitating a higher charge for service. This would militate against the economic adoption of subway systems in cities of the third class. Mr. Elliott's paper was a masterly presentation of the topic to which he has addressed himself so ably on former occasions, holding that the commodity produced, illumination, should be the unit of money value, and not the occasion of the commodity, electricity. Mr. Marston summarized the conditions of municipal ownership in the state and concluded that, for the present, the agitation in favor of municipal ownership had received a decided setback.

A motion was passed giving the executive committee power to discover whether it was feasible to continue the publicity work on the same basis as it was carried out during the year just closed.

A committee on taxation was appointed as follows: T. R. Beal, L. C. Palmer, S. R. Bradley.

The following officers were declared unanimously elected:

President, S. R. Bradley; vice-president, P. T. Glidden; treasurer, T. O. Horton.

Executive committee: Arthur Williams, W. T. Morris, R. M. Searle.

After a vote of thanks had been passed to the authors for the presentation of papers, the New York Edison Company for affording such fine meeting quarters, and the secretary, Charles H. B. Chapin, for his efficient services, the meeting stood adjourned.

CALCULATION OF ILLUMINATION FROM INCLINED LIGHT SOURCES.

BY J. S. CODMAN.

When the illuminating engineer has occasion to calculate the value of the illmination at some point on a horizontal plane due to some light source, he is obliged to ascertain the value of the candle-power in the direction of the point in question. This value he usually obtains from a photometric curve of the light source, such a curve, for example, as is shown in Fig. 1, but what particular value to take from the photometric curve is not always plainly evident.

In the case of the usual light sources such as arc and incandescent electric lamps, and gas and oil burners, the photometric curve is taken in a plane passing through the axis of symmetry of the lamp, and in such case the angle between the lamp axis and the direction in which candle-power is to be determined (which angle we will call θ) is the angle on the photometric curve of which the corresponding value of the candle-power is the one required.

If now the light source is used with its axis vertical, either upright or pendent, and if we call ϕ the angle between the vertical and the line of candle-power determination, see Fig. 2, we see at once that ϕ and θ are equal, and consequently the value of the candle-power required corresponds on the photometric curve to an angle having the value ϕ.

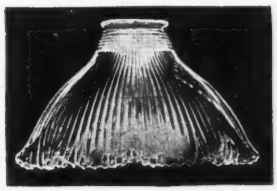
If, however, the axis of the light source is not vertical, but is inclined to the vertical at an angle A, see Fig. 3, then θ evidently does not equal ϕ. Nevertheless, if the line of candle-power determination lies in the same vertical plane as the axis of the lamp, see Fig. 3, the relation between ϕ and θ is still a very simple one, *viz.:*

$\theta = A - \phi$ when A is greater than ϕ.

$\theta = \phi - A$ when A is less than ϕ.

$\theta = 0$ when A equals ϕ.

In the above cases the determination of θ and hence of the candle-power in the required direction is very simple, but in the case when the lamp axis is inclined to the vertical at an angle A, and further the line of candle-power determination does not lie in the same vertical plane as the lamp axis, the relation between ϕ and θ is much more complex. In such case ϕ and A are in different vertical planes, making a horizontal angle B with each other, and the angle θ is not in a vertical plane at all, except in the one case when $\phi = 0$.



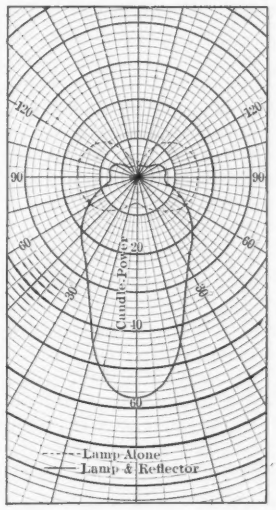


FIG. 1.—HOLOPHANE REFLECTOR NO. 2621 AND PHOTOMETRIC CURVE WITH SIXTEEN-CANDLE-POWER INCANDESCENT LAMP.

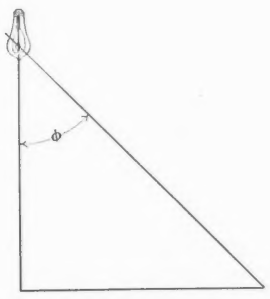


FIG. 2.—LIGHT SOURCE WITH AXIS VERTICAL.

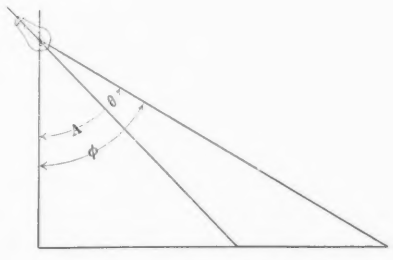


FIG. 3.—AXIS OF LIGHT SOURCE INCLINED.

The value of θ can be found, however, for any case from the following formula, proof of which is given later:

$\cos \theta = \sin \phi \sin A \cos B + \cos \phi \cos A.$

It will be seen that this general formula applies to the special case already given when the lamp axis is vertical. In such case $A = 0$ and therefore $\sin A = 0$ and $\cos A = 1$ and $\cos \theta = \cos \phi$, showing that $\theta = \phi$, as above shown.

In the other special case, that is, when A has a value greater than zero, and when ϕ and A are in same vertical plane, the formula also applies, since $\cos B = 1$, and therefore

$\cos \theta = \sin \phi \sin A + \cos \phi \cos A,$

from which it follows that

$\theta = (A - \phi)$ or $(\phi - A)$.

To illustrate the use of this general formula, let us suppose that we have a chandelier carrying ordinary electric incandescent lamps pointing in a downward direction at an angle of forty-five degrees and equipped with reflectors having the photometric curve shown in Fig. 1, and that we wish to calculate the illumination due to one of these lamps with reflector, at a point P in a horizontal plane six feet below the chandelier, the line of direction to the point making an angle of thirty degrees with the vertical and a horizontal angle of twenty degrees with the axis of the lamp.

The illumination is calculated from the usual formula

$$I = \frac{\text{candle-power} \times \cos^3 \phi}{h^2} = \frac{\text{candle-power} \times \cos^3 30^\circ}{36} = \text{candle-power} \times 0.018.$$

To determine the candle-power we must first find the value of θ from the formula $\cos \theta = \sin \phi \sin A \cos B + \cos \phi \cos A$, which, if above assumed values are substituted, becomes

$\cos \theta = \sin 30^\circ \sin 45^\circ \cos 20^\circ + \cos 30^\circ \cos 45^\circ,$

or $\cos \theta = 0.945$

and $\theta = 20^\circ.$

Referring to the photometric curve we find that the value twenty degrees corresponds to thirty-seven candle-power, and the equation for the illumination is therefore $I = 37 \times 0.018 = 0.67$ candle-feet.

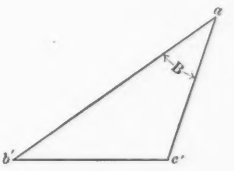


FIG. 4.—CALCULATION OF ILLUMINATION FROM INCLINED LIGHT SOURCES.

We come now to the proof of the formula

$\cos \theta = \sin \phi \sin A \cos B + \cos \phi \cos A.$

In Fig. 4 is shown the angle B, that is, the horizontal angle between the lamp axis and the line of candle-power determination. Since B is the projection on the horizontal of the angle θ, ab' and ac' are the projections of ab and ac, which are the lines of candle-power determination and lamp axis respectively. If we lay off ab and ac as each equal to unity, then ab' equals sin ϕ and ac' equals sin A.

Further, $(b'c')^2 = (ab')^2 + (ac')^2 - 2\ ab' \times ac' \cos B = \sin^2 \phi + \sin^2 A - 2 \sin \phi \sin A \cos B$.

But $b'c'$ is the projection of bc, therefore

$(bc)^2 = (b'c')^2 + (\cos \phi - \cos A)^2 = \sin^2 \phi + \sin^2 A - 2 \sin \phi \sin A \cos B + \cos^2 \phi - 2 \cos \phi \cos A + \cos^2 A = 2 - 2 \sin \phi \sin A \cos B - 2 \cos \phi \cos A$.

Now $(bc)^2 = (ab)^2 + (ac)^2 - 2\ ab \times ac \cos \theta$, and as ab and ac are unity by hypothesis,

$$(bc)^2 = 2 - 2 \cos \theta \text{ and}$$

$$\cos \theta = \frac{2 - (bc)^2}{2},$$

or substituting the first expression for $(bc)^2$, we have

$$\cos \theta = \frac{2 - [2 - 2 \sin \phi \sin A \cos B - 2 \cos \phi \cos A]}{2},$$

or finally

$\cos \theta = \sin \phi \sin A \cos B + \cos \phi \cos A$.

This formula can be made use of in calculations of illumination as in the case illustrated above, but by its use also we are able to calculate photometric curves of clusters of lamps with sufficient accuracy for working purposes, thus saving the delay and expense of actual measurements.

An example of such a calculation and a comparison of the calculated results with those obtained from test was described by the author in a paper entitled "A Check on the Reliability of Photometric Curves," read before the Illuminating Engineering Society at the first annual convention in July, 1907.

Melbourne and Sydney Telephone Line.

Consul-General John P. Bray reports that the two leading cities of Australia, Melbourne and Sydney, are now connected by telephone, the line being officially declared open on July 10. The line is a little over 600 miles in length and is composed of two exceptionally strong and heavy copper wires; the cost of construction was $227,198, and it took four months to complete. The fee for conversations, $1.46 for three minutes, is thought to be too high in business circles, but the postmaster-general, by whose department the line is controlled, has stated that if after three months' trial the line proves payable a series of progressive reductions in the rate will be made.

The New York City Municipal Lighting Plant.

To the Editor of the Electrical Review:

It has been stated, quite recently in the daily press, that the municipal incineration and electric lighting plant, Delancey Slip, N. Y., which has been in operation for about three years for lighting the Williamsburg Bridge was a failure, was too costly in operation, and has been abandoned in favor of the use of electric current from the New York Edison Company service.

In your editorial on this subject in your issue of August 24, 1907, you go into this matter at some length, and conclude with the statement "nevertheless the fact remains that it has not been found profitable to light the Williamsburg Bridge from this municipal plant."

You also criticize unfavorably the use of "refuse" as a fuel.

Whether the municipal operation of electric lighting plants can or can not be made a general success is a mooted question at the present time and one which I am not going to discuss in this letter.

As to the specific case of the municipal plant under question, I desire to say, however, that it seems odd, to say the least, that it should be abandoned as unprofitable and unsuccessful, if the favorable statements heretofore made regarding its satisfactory operation are to be believed, and I am inclined to the opinion that if all of the facts concerning the conception and operation of this plant were known and the real or fancied necessity for giving it up and letting the New York Edison Company operate in its stead were carefully inquired into, a somewhat different aspect might be given the matter.

In a very complete and exhaustive paper presented to the American Society of Civil Engineers by Mr. H. de B. Parsons, who designed and supervised the construction and installation of the Delancey Slip municipal plant, which paper was published in the society's proceedings for April, 1906, he says:

"This combined plant was built by the departments of street cleaning and of bridges for the benefit of the municipality, and each department retained the writer as consulting engineer to prepare the plans and superintend the construction. The department of street cleaning gains by having the rubbish collections reduced in bulk and transformed into ash which is valuable for land-fills, and by the improved sanitary conditions caused by completely burning the beds, bedding, and old furniture, which are often germ laden, and thus preventing them from ever returning to the city. The department of bridges saves in the cost of lighting the bridge by using the heat of combustion for the generation of electricity. To show how well these objects have been realized is part of the subject of this paper."

The total cost of the entire plant is given at $83,584.00, of which the incineration plant cost $34,193.00, and the electric plant cost $49,391.00.

In concluding this paper Mr. Parsons states that "the operation of this plant by the city showed a total net saving to the city of $30,733.00 for the year 1905, or 36.7 per cent of the investment, this being divided into a saving per year of $13,483.00, or 39.4 per cent on the cost of the incineration plant, and $17,250.00 or thirty-five per cent on the cost of the electric plant."

If this could be accomplished in 1905 when the plant was as yet a new proposition, why could it not be done at even better rates in 1906 when the proper working of the plant was thoroughly understood?

May there not be some other much more cogent and potent reason for the abandonment of this plant other than that of unprofitableness and lack of success in operation?

That part of your editorial which has to do with the use of rubbish as a fuel, and the statement made by you that such use is unsatisfactory and expensive, deals with a subject of great importance and value and is one in which I, as an engineer, am deeply interested.

In an article published in the *Brooklyn Daily Eagle*, August 9, 1907, Chief Engineer Lacombe is quoted as stating that "the main reason for the change (from a municipal plant to the Edison Company service) was the slow-burning quality of the fuel (refuse). It would not always burn readily and steadily and it caused the lighting to be uncertain. It was found necessary to change to definite, always ready power, which an electric company could furnish."

In your editorial you also state, "Very few engineers would to-day recommend the use of refuse for fuel if this were the only end sought, but since refuse must be got rid of some way or other, it is a question of hauling it away or of burn-

ing it; and which of these is the cheaper will depend upon local conditions.

"Probably some years hence the value of city refuse will be better appreciated or means will be developed for enabling this to be turned into profit, but at the present time destructor plants are operated at an expense.

"Some steam can, of course, be raised in these destructors, and should be utilized if practicable; but it happens that refuse is very bad fuel for supplying steam to a variable load. Destructors are at their best when operated continuously, and can not be forced economically. Electric lighting, however, is required only during a part of the twenty-four hours, and it does not furnish an altogether satisfactory load for a destructor plant."

With these statements I must respectfully take issue. The incineration of rubbish or refuse is not only a success in many parts of the world, especially in England, but does furnish, where the supply of such fuel is sufficient, the cheapest and most economical source of power known, and where the supply of such fuel is insufficient it can be and is supplemented by other fuels, the total cost of operation being most economical and satisfactory. This is not hearsay on my part, but is amply borne out by the published reports on this subject.

As regards the municipal plant in question, there was no lack of well assorted rubbish for use as fuel, in fact there was so much of it that the incineration plant was kept running day and night in a constant effort to consume the supply. The refuse was carefully sorted by a contractor who paid the city for the privilege of so doing, so that only what might be called "light rubbish" was used as fuel, and this cost the city almost nothing delivered at the furnaces of the boilers. For at least twelve hours out of the twenty-four the boilers were making steam and blowing off without any use being made of the power so generated. A good storage battery plant would have utilized this waste power and would have helped steady the variable load, though how a fixed number of electric lights, burning a fixed number of hours each night in the year can be considered a variable or unsteady load, I am unable to quite comprehend.

Light or assorted rubbish such as was used in the Delancey Slip incinerators is quite uniform in quality, burns readily and easily, has a heat value of about twenty-five pounds of rubbish to the horsepower-hour, and where the cost is practically nothing and the supply almost unlimited, as it is in the city of New York, it would seem to be an ideal fuel and a source of power of such low cost that competition from other sources of power using more costly forms of fuel would be out of the question.

There is no question as to the value of the economy of the incineration of waste materials as fuel for the generation of power, and that this is so is amply demonstrated daily in many places and its use is surely on the increase rather than on the decrease.

E. R. KNOWLES.

New York, September 17.

[The engineers of the department of water, gas and electricity of the city of New York state that the change referred to in Mr. Knowles's letter was made because it was cheaper to buy current for lighting the bridge than to produce it in this plant. We have not sufficiently detailed reports of the operation of this plant to show Mr. Knowles why this condition existed.

The lighting at this bridge was done, of course, only during the night. Such a load is certainly not best suited for a destructor plant which receives its fuel during the daytime and must therefore not only provide storage for this bulky material but handle it a second time, and which operates best when run continuously. In the particular case in New York it happened that the plant was small and there was considerably more fuel than was needed for the small amount of lighting done.

Mr. Knowles uses the word "refuse" in a limited sense. It is probable that light, assorted refuse containing no ashes nor garbage, such as was supplied to the New York plant, may have a value as a fuel, but city refuse, using the word with its general meaning, is not usually thus assorted, and so far as we have been able to learn such material has not been found to be valuable as a fuel, and when burned, its destruction is the chief end sought.—ED.]

Metallic and Other High-Efficiency Filaments.

A description is given here of a method of manufacturing metallic filaments for high-efficiency lamps which has been patented by the British Thomson-Houston Company. The method has been devised for producing highly refractory electrical conductors from metals which are not easily worked in the pure condition. The process consists in impregnating a refractory metal, alloy or compound with a ductile metal or alloy and the product thus obtained is sintered together either before or after mechanical manipulations such as rolling, drawing and squirting. The process is applicable to the production of filaments from such substances as tungsten, molybdenum, boron, zirconium, titanium and alloys of such metals. The ductile metals used for impregnation may be copper, cadmium, gold, silver, mercury, bismuth, tin, and others, or alloys of such metals. When a very high temperature is not required for the treatment, the process may be carried out in a glass vessel. The material to be treated is pressed into the form of a rod and suspended in the upper part of the vessel. The ductile metal is placed in the lower part, where it is heated to the proper temperature. By means of an air-pump the vessel is exhausted and the rod lowered until contact is made with the liquid metal in the bottom of the vessel. The rod is then lifted and an arc drawn, the rod being the anode of a direct-current arc. The heating of the rod in this way drives off occluded air and other gases which are removed by the air-pump. After a few minutes of such treatment the rod is free from the gas and is in a clean and porous condition. It is then suddenly lowered into the liquid metal which percolates through the rod and completely fills the pores. The rod is then withdrawn from the liquid metal and allowed to cool, after which it is removed from the vessel and subjected to the desired mechanical treatment. It is found to be ductile and easily worked. After the filament has been formed it is heated by the passage of a current through it while in a vacuum or surrounded by an inert atmosphere, the temperature being raised to the point where the ductile material is vaporized and driven off, leaving behind a filament of coherent sintered refractory material. The rods may be subjected to this treatment before the filaments are formed. If the temperature required to fuse the impregnating material is higher than can be reached in the glass vessel referred to above, the material is placed in a suitable crucible and the rod to be treated is stood on end in this. The crucible is placed in a suitable furnace and heated to drive off all occluded gases. Then the temperature is raised so as to melt the more fusible material, which is drawn up by capillary action until the rod is completely impregnated, when it may be subjected to any desired treatment. The condition of the impregnated rods depends upon the kind and amount of ductile material taken up, which in turn depends upon the fineness of the materials used in preparing the rods. The treated rod may be so soft that it may be expressed through heated dies.—*Electrical Engineer, (London), September* 12.

FREIGHT AND EXPRESS RATES ON ELECTRIC LINES.

DISCUSSION BY THE STREET RAILWAY ASSOCIATION OF NEW YORK STATE.

One of the important discussions at the convention of the Street Railway Association of New York State, held at Kingston, N. Y., September 21, was on the subject of "Freight and Express Rates." The subject was introduced by a paper under this title by Frank Walsh, of the Schenectady Railway Company. An abstract of the paper follows:

The writer was for a number of years in the employ of the old line companies, who operate over the steam roads and cover thousands of miles of territory. When he entered the service of the electric lines who do only a local business, he felt that it would be so easy, after his previous experience, that as the saying is, there was nothing to it.

He soon found he was mistaken, and that there was a whole lot to it. It opened up an entirely new field, and it was necessary to apply methods that suited the locality.

One of the first things to do is to size up the territory and ascertain if it produces or consumes, and he would strongly advise any one who contemplates engaging in the freight and express business to look the ground over very thoroughly.

Another very important point is the rate question.

Some managers advocate class rates as adopted by steam roads. Others favor the flat rate as used by the old line express companies.

The steam roads have eight different classifications.

Four, or even three, would be enough for electric roads.

In his judgment, the low class freights do not pay for the trouble of handling, and with the prompt service that electric lines are able to give on local freight, they should look for the high class commodities. If any merchant is in a great hurry for heavy, rough material and to save time is compelled to ship by electric roads, he will gladly pay what the difference would be in the classification.

He finds that in most cases the electric road can get all the steam road asks, and often a trifle more, for it stands to reason that the service is much better and the primary object in electric freight and express service is promptness and delivery at destination.

The company's business is classified as follows:

Class "A," handling at a flat rate all goods which it is expected to pick up by wagon and deliver. This class of business is given preference in loading and delivering.

Class "B" rate is applied on all shipments that are delivered at the company's terminals and called for at destination by consignees.

Class "C" freight includes wagon service on one end (as a general thing the delivery) and applies mostly on shipments from wholesale houses to stores in various places. This class is used by most people and is a popular one with the big shippers.

About fifty per cent of the company's business is handled under Class "C," as it simply charges, in addition to the freight rate, a fair delivery charge. This class does not apply on goods of a perishable nature.

Any company which does not use wagons in connection with its freight cars is doing only a freight business; where wagons are maintained it is doing both. Anything that is handled by wagons either on one end or both, his company classifies as express, and where no wagon service is required, it is classified as freight.

C. H. Armatage, traffic manager of the United Traction Company, Albany, N. Y., said that the value of an electric express service lies in the great saving of time, the frequency of trips over short mileage routes, the speedy transportation of farm products and garden truck from the rural district to the cities, the filling of rush orders by telephone, the ability to make fast time and deliver at highway crossings or at store doors.

The one item of expense in operating an electric express service, and which practically absorbs an enormous part of the net earnings, is that of wagon call and delivery.

Some roads have a practice of adding a certain per cent to their tariff rates to cover the expense of such delivery; other roads maintain a regular schedule of express rates covering call and delivery service.

He had personally visited several electric express companies operating in the New England states and found upon investigation that the cost of maintaining teams for delivery service consumes such a large proportion of the profits that managers are considering the cutting out of this item of operation.

It is a fact that the Connecticut company which is the holding company for the New York, New Haven & Hartford Railroad electric properties has eliminated this item of expense in several of the cities in which it operates and is now confining itself strictly to frequent service and cooperation with the shipper, feeling that such methods more than compensate its patrons for any advantage that might be gained in maintaining a call and delivery service by team.

Good sound judgment should be exercised in determining the character of freight and express matter handled. It does not matter whether consignments consist of feathers or lead with some shippers, who insist upon their rights as described in printed folders giving rates and information, and demand transportation of their goods accordingly.

Such shipments as wool, rags, paper junk, and such material that not only blocks platforms, impede the work, and fill the cars to the detriment of good paying freight, should be termed excepted articles and rated accordingly.

Also, iron, steam piping (unless short lengths), heavy machinery, doors, sashes and lumber should be excepted, and household goods, such as stoves and furniture, unless properly boxed or crated, should be accepted for transportation only upon release from the consignee from all claim for breakage and damage in transit.

The handling of such goods should be well paid for, for the reason that it takes valuable time, and invariably they have to be carted to the very extreme of the delivery boundaries and the teamsters in most instances require assistance to unload them; this of course refers to such service requiring call and delivery.

He believed a rate classification in electric express business should be avoided if possible, if such rate classification is to be considered on the lines of the official classification, as used by steam roads. His experience has taught him that local agents do more guessing than they ought to, and in many instances such guessing, when shippers happen to make comparison, leads to charges of discrimination.

Steam railroads vary in their distinction of classes. Some classes are subject to certain rules. The agent does not take time or think it necessary to perfect himself on these rules and the result is that there is a conflict opened between the shipper and the carrier.

To avoid such contingencies, on railroads having short mileage hauls, he would recommend or suggest that flat rates be established, with the necessary exceptions, also a minimum rate to suit the locality and the conditions.

He is of the opinion that a first-class

commercial agent attached to any electric express company who has the personality to reach the shipper and can offer a tariff which would be a compromise between the freight rates of steam roads and the express rates of regularly incorporated express companies in competition, would in a very short time produce astonishing results and materially increase the item of profit to the carrying company.

The United Traction Company is undoubtedly the pioneer in electric express and freight service, having been in operation some thirteen years, and from a business the first year of nine thousand dollars has steadily increased to forty-nine thousand dollars for the year 1907.

This phenomenal showing is due to the constant endeavor to please shippers and to display a spirit of cooperation.

Another speaker said that for some time he had made an analysis of the cost accounts of operating freight departments on several roads throughout the country, when it became very noticeable that the only items that were entered as making up the cost of handling freight were those that were purely visible, together with an arbitrary pro rata charge for several of the operating men without regard to the real business handled by them.

After looking these reports over, he began to analyze the same account on his home road, and discovered the same practice to be in vogue there; consequently, in the year 1906, he decided to and did reduce the entire traffic of the road, both passenger, freight and work-train service, down to a basis of a ton carried a mile, and then pro rating the cost of the different operating accounts on this basis between these three services. In arriving at the ton-mileage handled over the road, the rolling stock was figured as empty cars at their actual weight. The passenger load was figured from the average distance of passengers carried on a basis of 135 pounds per passenger. The freight and express was figured at the actual weight from point to point. This gave 27,545,397 ton-miles of passenger, freight and express and work-train service chargeable to Accounts 1 and 2, and the power, and 26,873,247 ton-miles of passenger, freight and express service chargeable to Accounts 6 and 7. There were 2,153,412 ton-miles of work-train service chargeable to Account 8, and 2,190,135 ton-miles of freight and express chargeable to Account 39. The above figures include rolling stock and load.

The revenue express was 12,139 ton-miles, the local freight 1,070,461 ton-miles, and carload freight 108,092 ton-miles. The operating expenses chargeable to combined freight and express per revenue-ton-mile were as follows:

Account No. 1	0.00082
Account No. 2	0.00003
Power	0.00262
Account No. 6	0.00053
Account No. 7	0.00029
General expense less account No. 39	0.00152
Account No. 39	0.01242
Total	0.01824

The revenue freight and express ton-mileage amounted to—freight, ninety-nine per cent of the total; express, one per cent.

The express is handled on the same basis as the other express companies operating over the steam roads, and pays a collection and delivery charge for cartage of forty per cent of the express receipts; consequently in making a pro rata charge between freight and express, this forty per cent must be deducted from Account 39 and charged direct to the express account, and then the other accounts, together with Account 39, would come under the pro rata on the basis of ninety-nine per cent and one per cent. These accounts, between freight and express, would come out as follows:

	Freight.	Express.
Account No. 1	0.0082	0.0008
Account No. 2	0.00003	0.0000
Power	0.00261	0.0026
Account No. 6	0.0063	0.0005
Account No. 7	0.000029	0.0002
General acct. less acct. 39	0.00163	0.0015
Account No. 39	0.01048	0.2103
Total	0.01646	0.2159

INCOME PER TON-MILE.

Express	0.50
Local freight	0.01148
Carload freight	0.02626
Average of freight	0.01284
Average of freight and express	0.0178

Recapitulation of operating expenses and income per ton-mile:

OPERATING.

Express	0.2159
Freight	0.01646
Freight and express	0.01824

GAIN OR LOSS.

Express, gain	0.2841
Freight, loss	0.00362
Freight and express, loss	0.00044

This same year under the system of expense charging against freight and express, which as before stated contains only such charges to Account 39 as are actually seen, shows a gain of 0.00505 per ton-mile in receipts over expense, whereas according to the above analysis, it should have been a loss of 0.00044 per ton-mile.

From an inspection of the different costs and receipts of the freight and express handled, it will be seen that the entire loss comes through the handling of package freight. The reason for this is that scarcely any of the trolley roads are so situated to be in any kind of shape for properly handling this class of freight, consequently the continuance of handling this package freight merely resolves itself down to a question of policy, whether the railroad company is a gainer in the long run by handling package freight as an accommodation to the public and a loss to the company, or reorganize the freight business and place it on a paying basis.

He believed it better for the majority of electric roads to cut out the local freight business and handle nothing but express, dividing it into two classes—one that the roads collect and deliver, the same as the other express companies; the other class, where there is no collection or delivery made, the rates charged for this class to be forty per cent lower than the first class; and such roads as have interchange connections with steam roads to handle only such freight as can be handled in carload lots, where the shippers do their loading and unloading.

Wireless Communication Between America and Europe.

William Marconi, the inventor of the Marconi system of wireless telegraphy, arrived at Glace Bay, Nova Scotia, on September 23, and announced that he intended to stay at Glace Bay until wireless communication with Europe had been established on a commercial basis. Mr. Marconi stated that this would be possible in about three weeks. The new European station at Clifden, Ireland, has been fitted out with modern apparatus much more powerful than that of the older station at Poldhu, Cornwall. The Poldhu station, however, will be utilized as a secondary plant.

It was stated at the New York offices of the Marconi company that Mr. Marconi's statement with regard to the time when commercial communication would be established was very conservative. As a matter of fact, those interested in the development of the system expect an even earlier realization of their plans.

Wireless Telegraphy.

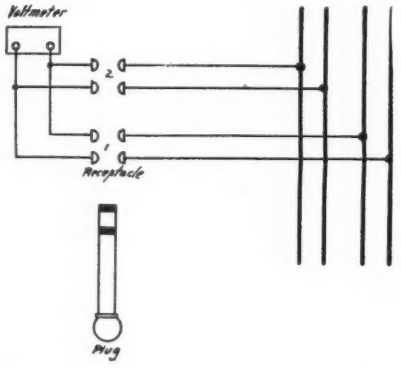
A British consular report states that a wireless telegraph station has been established on high ground in western Dieppe, France, for experiments with the Artom system. Communication and experiments are proceeding with Havre, and the masts are being prepared for a station at Barfleur, France.

SWITCHBOARDS FOR SMALL STATIONS.

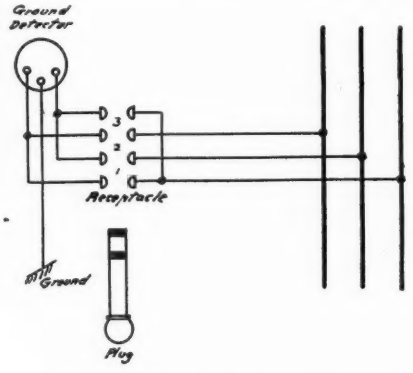
BY E. T. MUG.

In any central power station, the switchboard is of such importance that the efficiency of the station, from the standpoint of service rendered, may be very materially affected if the switchboard design is not such as will permit dispatch in handling the generators and the circuits.

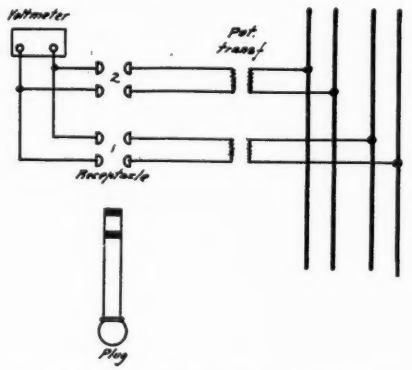
Freedom from shut-down, either due to accidents in the station or to trouble on the line, may be guarded against by a proper arrangement of throw-over switches or synchronizing apparatus and by the employment of ground detectors for detecting trouble on the line, and lightning arresters and static dischargers for protecting the apparatus and cables.



TWO PHASE, 600 VOLTS MAXIMUM. VOLTMETER READING ACROSS EACH PHASE.



TWO-PHASE, 600 VOLTS MAXIMUM. SINGLE-PHASE GROUND DETECTOR READING BETWEEN EACH LINE AND GROUND.



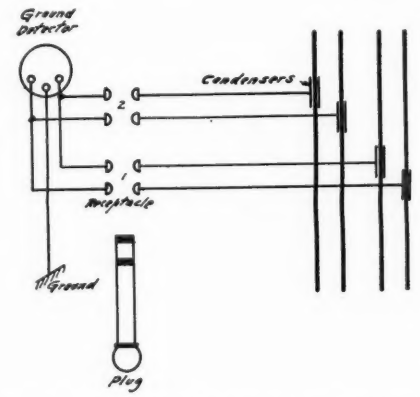
TWO-PHASE, ABOVE 600 VOLTS. VOLTMETER READING ACROSS EACH PHASE.

Besides, uninterrupted service, records of total output, of voltage and of load, on individual generators are of more value than may be apparent at first sight. A recording wattmeter of the curve tracing type, furnishes an automatic and continuous record of output or individual load; an integrating wattmeter gives a record, a summary, of the energy delivered for any given period of time; a recording voltmeter enables the central station manager to know if the fluctuations are too great for good service and by studying the records closely from day to day he can often locate the cause of accident to a machine or of a disturbance on the line, and he can provide against overloads by knowing just when the peaks of the load may be expected.

In the case of isolated plants, such records are only of a lesser value and often the information gained from them may lead to a better method of handling the load and this in turn, to better service at lower cost for power. Where power is purchased, the value of recording instruments, as a protection to the consumer, is most apparent.

Since the advent of very large central stations and very high voltages, conditions have arisen calling for elaborate switchboard layouts and remote control apparatus. This is very advisable where a large amount of power and high voltages are handled, but the apparatus is necessarily complicated and should have no place in stations of small capacity and moderate voltage.

The mechanical design of switchboards has been much improved in the last few years. The angle-iron frame construction which was such a step in advance of the wooden framework, is now giving place to a skeleton frame made up of one and one-quarter inch wrought iron pipe and malleable iron fittings. This construction permits of carrying the small potential wires along from one panel to the next directly on the back of the panels, as the pipe supports stand one and one-half inches away from the marble. Better adjustment of the panel supports is also possible as they are all clamped to the pipe and can be readily secured in their proper position, thus relieving the marble of all unnecessary strain due to bolt holes not matching up exactly.



TWO-PHASE, ABOVE 600 VOLTS. GROUND DETECTOR READING BETWEEN EACH LINE AND GROUND.

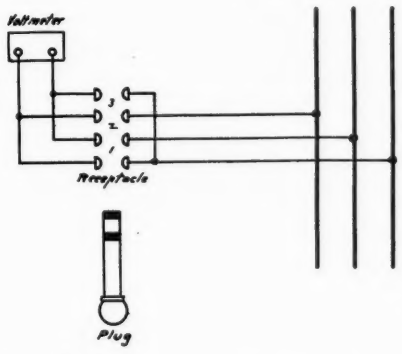
Blue Vermont marble is in general favor for panels. It is mechanically stronger than most other marble and is practically free from hard kernels, thus making it more sure to drill, as the drill will work sideways if the material is not of uniform hardness. White Italian marble looks very fine but it is soft and shows oil spots very plainly. In this connection it may be interesting to know that the worst spots of clean or dirty oil on blue Vermont marble or even on white Italian marble may be entirely removed, even if of long standing, by laying the marble face up on trestles and applying a heavy coating of turpentine on the spot, and keeping it well coated until the turpentine soaks through and drops off the back freely; then going through the same process with gasolene until all the turpentine is removed. This treatment will require six or seven days for the worst cases, but will remove every trace of the spot.

Black enameled slate makes a very serviceable board and has the advantage over marble of not being affected by oil, but it has the disadvantage of being hard to obtain free from metallic veins, so that its use, except for low potential service, is not recommended.

The needs of direct-current constant potential plants are few in the way of switchboard apparatus, and beyond the usual main circuit-breakers, equalizer and feeder switches, field rheostats, volt and ammeters and ground detector, there are hardly any refinements necessary. Recording instruments may still be in good taste, also an extra set of bus-bars and possibly feeder circuit-breakers instead of simple knife switches, in which case the main circuit-breakers may be replaced by fused knife switches. The use of circuit-breakers on the feeder circuits, and fused main

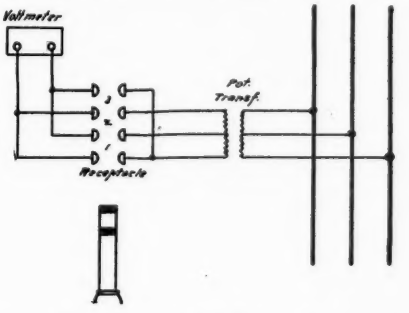
knife switches is to be recommended, as the effect of an overload or short-circuit on a feeder will be to cut out that feeder alone and will not interrupt the service to the others.

An instrument in which are combined a voltmeter, an ammeter and a power meter, is quite a convenience on direct-current boards. The volts and amperes are indicated by separate pointers on separate scales and the power is indicated by the intersection of these two pointers over a third scale.



THREE-PHASE, 600 VOLTS MAXIMUM. VOLTMETER READING ACROSS EACH PHASE.

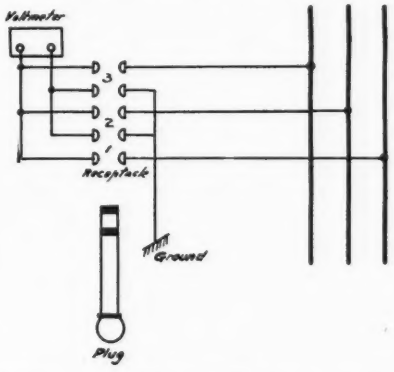
Single-phase alternating-current boards may follow along the lines of direct-current boards with synchronizing apparatus in place of equalizer switches, and if the potential is above 600 (six hundred) volts, automatic oil circuit-breakers should replace the air circuit-breakers, and fused potential transformers should be used.



THREE-PHASE, ABOVE 600 VOLTS. VOLTMETER READING BETWEEN PHASES.

The control of two or three-phase apparatus requires more complicated boards, but beyond the extra instruments, the voltmeter switch and the ground detector plugs, all complications and unnecessary refinements are only sources of trouble.

Each generator, each exciter and each feeder circuit, should have a separate panel, mounting only such instruments and switches as belong to the individual unit and only such apparatus as must be handled or read frequently. As far as possible, auxiliary apparatus, such as potential transformers, ground detector condensers, time limit relays, etc., should be carried directly on the framework or the wall braces, and series transformers should be located almost as an afterthought on the leads on which they belong. Quite often they can be placed below the switchboard gallery or on the wall behind the board; in fact, anywhere, so long as the most direct path for the leads is not departed from. High-tension busbars should be carried on special insulators preferably located above the reach of the attendant; on the wall braces is a good place, as it is safe and allows the connections to drop straight down without other support to the switches.



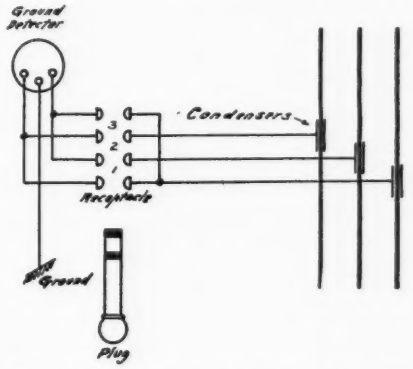
THREE-PHASE, 600 VOLTS MAXIMUM. VOLTMETER READING BETWEEN EACH LINE AND GROUND.

Potential transformers should always be fused on the primary side, as a short-circuit here might prove as disastrous as one directly across the mains, especially if the main generator switches are non-automatic.

Automatic overload switches should be used on the feeder circuits, and non-automatic switches on the generator leads, or, time limit relays and automatic switches may be used throughout, in which case the relays on the feeder switches should be regulated to act in say two seconds, and those on the generator switches in six seconds. Such an arrangement as this will serve to localize any trouble and will prevent total interruption of service due to overload or short-circuit on a feeder.

An improved plug-switch of recent design consists of an insulated plug and handle on which are mounted copper rings. This plug passes through a bushing on the board, and makes contact through the rings with a series of contacts on the back of the board. The plug is graduated for two or more positions; each position giving a phase reading. This device has the advantage over all others of being more simple and of requiring only one hole in the board. The accompanying diagrams show the adaptability of this device.

In a short time, double and triple scale indicating instruments will be on the market. Their use will reduce to a minimum the number of separate instruments necessary, and the scales being horizontal and one above the other, will make comparison of the readings very easy. Multiple-scale voltmeters will in some cases, do away with the necessity for the plug switches such as the improved style just described, and will not add any other complication, as the two potential transformers, "V" connected in use for three-phase work, will be all that is needed. For the three-scale ammeter or wattmeter, only two series transformers need be used.

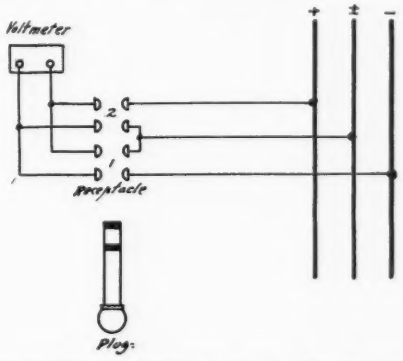


THREE-PHASE, ABOVE 600 VOLTS. SINGLE-PHASE GROUND DETECTOR READING BETWEEN EACH LINE AND GROUND.

Multiple-scale wattmeters are more desirable than polyphase wattmeters on feeder circuits as they indicate the distribution of the load on each phase.

Polyphase wattmeters and ground detectors are preferable to single-phase instruments on account of the smaller space necessary for them, and because they are direct reading, and require no plug switches.

In laying out a power-station building, the switchboard is seldom given sufficient consideration. It is even difficult sometimes, to obtain information from the customer as to how the mains and feeders will be located, although this is necessary before a properly arranged switchboard can be conceived of.



THREE-WIRE, DIRECT-CURRENT, 600 VOLTS MAXIMUM. VOLTMETER READING BETWEEN EACH OUTSIDE WIRE AND NEUTRAL.

The present practice of mounting the apparatus on vertical marble or slate panels, can be simplified by designs of pedestals or columns, carrying the instruments, and by the use of bench boards. These will come into more general use as their practical value is recognized, and as the well-rooted preference for polished marble, sometimes even polished on both sides, gives way to the growing tendency toward simplicity and directness.

ELECTRIC MOTORS FOR CEMENT MILLS.

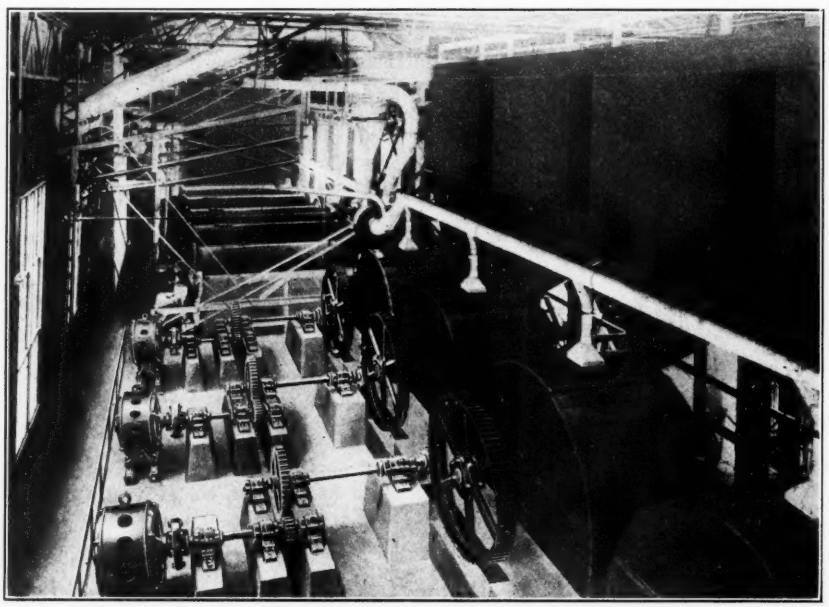
BY R. B. WILLIAMSON.

For driving the various machines used throughout a cement mill, electric motors are now almost universally employed, especially in some of the more modern mills, such as those for which Allis-Chalmers Company, of Milwaukee, has built and installed the complete equipment, the electric drive having here the same advantages of flexibility and economy that have been demonstrated in so many other lines of work. The elimination of belting and countershafting is specially desirable in a cement mill, where the gritty dust makes the maintenance of both belts and bearings expensive.

In some mills, particularly those located in the West, power is purchased from transmission companies, but usually each mill is provided with a steam plant of its own. In either case the alternating-current system is almost invariably used in modern installations and it may be either sixty or twenty-five cycles, two or three phase. Although direct current has been used in a few cases, the present practice is to use alternating-current motors almost exclusively for this class of work. The polyphase induction motor has many advantages, not the least of which is the absence of commutator and brushes. The cost of maintenance is less than for direct-current machines, and in the dusty atmosphere of a cement mill, the simple "squirrel-cage" rotor of an induction motor is much less liable to give trouble than the wound armature of a direct-current machine.

In these mills the motors are used for operating rock crushers, ball mills, tube mills, rotary kilns, hoists, conveyers, pumps, etc.; in fact for all the machines used throughout a modern cement plant. In most instances the motors are run at or near full load continuously, and the service as a whole is especially severe. In nearly all cases they are of the squirrel-cage type with short-circuited secondary, a type that necessarily operates at constant speed. For variable-speed work the induction motors are provided with a wound rotor, connected, through collector rings and brushes, to an external resistance. By this means the speed can be varied at the expense of lower efficiency. However, collector rings and brushes are undesirable features when exposed to cement dust, and these motors are used as little as possible; they are installed occasionally for operating rotary kilns where a variation in speed is sometimes desirable, and also for electric hoists; but for practically all other classes of work constant-speed squirrel-cage motors are preferred.

Probably the most severe service is that demanded of motors for running ball and tube mills. These mills are used for grinding the raw material before calcining, and also the clinkers from the rotary kilns. For driving the ordinary sized ball mill a fifty-horse-power motor is required, while for a five-foot by twenty-two-foot tube mill a seventy-five-horse-power motor is usually installed; a five and one-half-foot by twenty-two-foot tube mill requires about ninety-five horse-power, and a six-foot by twenty-two-foot, 115 horse-power; the five-foot by twenty-two-foot mill is the size generally used.



INDUCTION MOTORS DRIVING BALL MILLS IN CEMENT FACTORY (PARTITION BETWEEN MOTORS AND BALL MILLS REMOVED).

Ball and tube mills, especially the latter, are difficult to start. The material clings to the sides of the mill, particularly in the tube mill, where pebbles are used to effect the grinding, and at starting the whole mass has to be swung up until the first half revolution has been made. This demands heavy starting torque, usually amounting to one and one-half to two times full-load torque. It is desirable therefore to use for these mills a motor having starting torque higher than for ordinary service; if this is not done, the motor will take an excessive current at starting, or, if the voltage drops to any great extent, the motor may even fail to start the mill at all. Motors for this service must be of liberal size to give the requisite starting torque, and also operate continuously at full load in a dusty atmosphere, without undue rise in temperature. It must be remembered that in cement mills the dust gets into the ventilating passages in the motor, and they may in time become clogged up, thus materially increasing the temperature rise.

The starting apparatus used with these motors must also be of liberal design in order to carry heavy starting currents. Sometimes the mills are started by throwing the current off and on, giving them two or three swings until they finally turn over. This is especially hard on the stator and should not be necessary if the motor has ample starting torque. All starters have oil-immersed switches for changing the connections from "starting" to "running," and transformers are provided so that a reduced voltage can be applied to the motor at starting, thus reducing the current taken from the line. For this severe starting service where the motors are frequently operated by an unskilled class for help, the starters can be fitted with a device that prevents the handle from being left on a starting position; if left on a starting position it at once returns to the off position, thereby preventing a burn-out of the starter.

Motors for operating these mills are usually belted and run at moderate or slow speed. On sixty cycles, fifty-horse-power motors running at approximately 850 revolutions per minute full load have been used for ball mills, but a slower speed motor is more desirable and 670

revolutions-per-minute-machines are now recommended. On twenty-five cycles, four-pole, motors running at approximately 700 revolutions per minute full load are used.

For five-foot by twenty-two foot tube mills a seventy-five-horse-power motor running at 670 full load on sixty cycles is suitable, while on twenty-five cycles, speeds of 700 revolutions per minute or 470 revolutions per minute are available, the latter being preferred. Motors are bolted directly to the main driving shaft on the mill from which the latter is driven through spur gearings.

As regards voltage and frequency, the majority of cement mills are operated on 440 or 550 volts and frequencies of sixty or twenty-five cycles. Although there are instances where 2,200-volt motors have been used, the lower voltages are preferable on account of the greater security of the insulation on the motors and greater safety in working around them. There does not appear to be any settled practice as regards frequency, either sixty or twenty-five cycles giving satisfactory results; in many cases the frequency is fixed by that of the transmission system from which power is obtained and most plants supplied from such systems are operated at fifty or sixty cycles.

As regards mechanical features, it is important that the bearing sleeves be arranged so that they can be readily removed and relined. All bearings are made as dust-proof as possible by means of felt dust guards, and journals are of liberal dimensions.

BOOK REVIEWS.

"Standard Polyphase Apparatus and Systems." Maurice A. Oudin. New York. D. Van Nostrand Company. Fifth edition. Cloth. 370 pages. 200 illustrations. 21 tables. 5¾ by 8 inches. Furnished by the ELECTRICAL REVIEW for $2.

In the fifth edition, this well-known book on polyphase alternating-current apparatus has been enlarged and brought up to date. It contains descriptions of the recent types of motors, generators, lightning arresters and other apparatus. The treatment throughout is descriptive, the object being to explain the methods of construction and the characteristics of the different types of apparatus used in alternating-current systems.

"Elements of Mechanics." W. S. Franklin and Barry MacNutt. New York. The Macmillan Company. Cloth. 284 pages. Illustrated. 6 by 9 inches. Furnished by the ELECTRICAL REVIEW for $1.50.

The authors of this text-book thoroughly believe in training the student in scientific methods of thought and experiment. The popular method of teaching science is not approved of, since any student who indulges a fancied interest in the results of science, becoming absorbed, for example, in a purely descriptive treatise on recent subjects, holds his imagination unresponsive. Holding these views, the authors frankly state that the correct study of a science must necessarily be tedious and dry, and then they proceed to make this study interesting by showing how the laws of physics, which to so many are indefinite and apart from themselves, are really the laws which govern all the actions going on about the student. Physical science, the authors believe, is an engine for helping the mind, and to construct it properly there must be a logical structure of mathematical and conceptual theory and a mechanical structure or suitably arranged plan for conducting experiments, or in other words, for testing the theory. The usual field covered by mechanics is taken up in the book, and the application of theory is everywhere shown by reference to actual apparatus in daily use, as well as by problems stated so that they have some meaning to the student.

"Armature Construction." H. M. Hobart and A. G. Ellis. New York. The Macmillan Company. Cloth. 348 pages. 420 illustrations and diagrams. 6 by 9 inches. Furnished by the ELECTRICAL REVIEW for $4.50.

This is another contribution to the excellent text-books on the construction of dynamos which have been prepared by these authors. The present book is limited, as its title shows, to the consideration of armature construction, but it takes up all of the phases of this work in a thorough manner. Five types of armature are considered: The continuous-current generator and motor, the alternating-current generator with revolving armature, the alternating-current generator with stationary armature, the rotary converter, and the induction motor. The study of cores is first taken up. This explains the specific qualities which the iron employed for the laminations should have; methods of testing and the best forms for the laminations and slots. The machinery used in preparing the lamination is also described. The armature frame is next taken up, and the methods employed of mounting the laminations for securing ventilation are thoroughly discussed. In the construction of small machines the assembling of the armature coil is a comparatively simple matter, but in the large machines it is a more serious problem. The methods which have been found most satisfactory for this work are clearly explained. The winding problem is then discussed at length and various special types of machines come in for special care. The construction of squirrel-cage armatures is fully described, the different practices employed by the makers being shown. Another important problem is the construction of the commutator for continuous-current machines. This is also satisfactorily treated. In the discussion of the various systems of winding, the free use of diagrams, especially colored diagrams, is very helpful. The book concludes with a discussion of methods of testing the completed machines.

"Electrons, or the Nature and Properties of Negative Electricity." Sir Oliver Lodge, D.Sc., LL.D. New York. The Macmillan Company. Cloth. 230 pages. 8½ by 5½ inches. Supplied by the ELECTRICAL REVIEW for $2.

This book, written in the characteristic style of the author, is based upon his lecture, concerning recent progress toward knowledge of the nature of electricity, before the Institution of Electrical Engineers of Great Britain, and printed in vol. xxxii of the Journal of the Institution. The subject is treated in twenty-one chapters and twelve appendices. The order of presentation is as follows: electric and magnetic properties of moving electric charges; historical review of the fundamental work of Maxwell, Stoney, Kelvin, Crookes, Lenard, Hertz and many others; determinations of ratio of charge to mass; determination of charge of electron; determination of mass and electromagnetic inertia; and the electric view of the constitution of matter. Ionization and the phenomena of radioactivity are given a brief treatment. There is also an inadequate and unsatisfactory treatment of the conduction of electricity and of radiation. In the last chapter an effort is made to harmonize present views with the author's modern views of electricity. In the appendices the derivation of many of the fundamental formulæ of the subject are given, with references to original sources. This portion of the book will prove of great value to seriously minded students. The discussions of the work of C. T. R. Wilson and of Thomson concerning the charge on an electron, of Kaufmann on the increase of mass with increase of velocity, and of Zieman, are very clear, full and exact. The illuminating style of the author can not fail to be pregnant with suggestions to workers in this field. It is to be regretted that the term electron is employed to represent particles carrying positive charges as well as negative. This is misleading, is inconsistent with the title of the book, and is doubtless due to the manner of preparing the manuscript by modification of a four-year-old lecture. An index would add materially to the value of the book.

The American Electrochemical Society.

The twelfth general meeting of the American Electrochemical Society will be held in New York city, October 17, 18, 19 (Thursday, Friday and Saturday of the third week of October).

The meeting will be opened by an evening session on Thursday, October 17. This session as well as the morning session on Friday, October 18, will be held at the Chemists' Club, 108 West Fifty-fifth street. The morning session of October 19 will be held in Havemeyer Hall, Columbia University.

Headquarters for registering and information are at the Chemists' Club. Hotel headquarters are at the Hotel Cumberland, Fifty-fourth street and Broadway.

On Friday afternoon an excursion will be made to the laboratories of Thomas A. Edison. Mr. Edison will receive the visitors personally. A special car will be provided on the Delaware, Lackawanna & Western Railroad, the train leaving West Twenty-third street at 2.15 P. M. On the evening of Friday a subscription dinner will be held in Liederkranz Hall. Ladies are specially invited.

On Saturday afternoon an excursion will be made to the new Pennsylvania Railroad power plant at Long Island City, the New York Electrical Testing Laboratories and other points or places of interest to be announced at the meeting.

On the evening of Saturday a smoker will be tendered to the American Electrochemical Society by the Chemists' Club.

During the meetings there will be an exhibition of some novelties of electrochemical products and apparatus at the Chemists' Club.

The programme of papers is as follows:

Thursday evening at 8 o'clock, illustrated lecture on "Diamond and Moissanite; Natural, Artificial and Meteoric," by Dr. George F. Kunz.

At 9.30 o'clock, lecture on "Deflocculated Graphite," by E. G. Acheson, of Niagara Falls, with demonstrations and experiments.

Friday morning session, at Chemists' Club at 9 o'clock, "On the Electrothermic Reduction of Iron Ores," Albert E. Greene and Frank S. MacGregor.

Discussion of the "Electric Furnace Experiments for the Production of Pig Iron at Sault Ste. Marie," Dr. Joseph W. Richards.

"Electric Furnace Experiments," Dr. H. N. Potter.

"Discussion of Moissan's Experiments on the Boiling Points of the Metals," Dr. O. P. Watts.

"The Electrometallurgy of Zinc," Gustave Gin.

"A New Application of Chlorine in Metallurgy," C. E. Baker.

"The Heat Conductivity of Carbon," F. A. J. FitzGerald.

"Granular Carbon Resistors," Professor S. A. Tucker.

Saturday morning session, at Columbia University at 9 o'clock—"Physico Chemical Notes on the Aluminates of Soda," P. B. Sadtler.

"Action of Ammonium Persulphates on Metals," J. W. Turrentino.

"Notes on the Use of the Capillary Electrometer for Alternating Voltages," M. G. Floyd.

"Electroscopic Determination of Radium in Some Tufa at Hot Springs, Ark.," Dr. Herman Schlundt.

"Electrolytic Separation of Silver and Copper," H. W. Gillett.

"Electrolytic Determination of Minute Quantities of Copper," E. E. Free.

"Electrolytic Reduction of Nitric Acid," Dr. H. E. Patten and A. Robinson.

"Electrochemical Methods for the Qualitative and Quantitative Determination of Free Silicon in the Presence of Silica, Silicates, Oxides, Free Carbon and Carborundum," W. R. Mott.

"On the Nature of Electrolytic Conductors," L. Kahlenberg.

"The Electrolytic Theory of the Corrosion of Iron," Dr. A. S. Cushman (lecture with demonstrations).

Professor A. S. Tucker, Columbia University, is chairman of the New York committee. Alois von Isakovics, Monticello, N. Y., is the local secretary.

The American Society of Mechanical Engineers.

The American Society of Mechanical Engineers will hold its first monthly meeting this fall on Tuesday evening, October 8, at 7.45 o'clock, in the main auditorium of the Engineering Societies Building at 29 West Thirty-ninth street, New York city.

The subject of this meeting "Industrial Education," is one in which manufacturers are very much interested.

The college technical courses and the student apprenticeship courses will be discussed at length by men who have been in charge of theoretical and practical institutions. Professor John Price Jackson has written a paper on the "College Technical Courses and Apprenticeship Courses Offered by Manufacturing Establishments." He gives data in the form of letters from several of the largest manufacturing establishments in America in which they outline the courses offered by the factories, and explain the manner of conducting the same.

Dr. Henry S. Pritchett, president of the Carnegie Foundation and president of the Society for the Promotion of Industrial Education, and Professor Dugald C. Jackson, of Massachusetts Institute of Technology and president of the Society for the Promotion of Engineering Education, will deliver short addresses on the subjects allied to their societies. Other manufacturers have been invited to speak informally at the meeting of their experiences and altogether it is expected that the meeting will prove interesting and instructive.

The Railroad Museum of the German Government.

In the issue of the *Railroad Gazette* for September 27 there is an article describing and illustrating the new railroad museum of the German government. This was formally opened by the Emperor some months ago, and all sections of the building are now open to the public. The museum is located in an abandoned terminal of the Berlin-Hamburg line in the northwestern section of Berlin. A large power plant has been installed to generate steam for heating and electricity for lighting and operating motors and for furnishing compressed air to work several models for demonstrating purposes. The exhibition space covers 52,000 square feet, and comprises a long main hall with an arched glass roof, and a number of smaller rooms in both wings. A few exhibits are so large, however, that they have been placed outside in the adjoining courtyard.

The museum comprises three large sections—railroads, marine engineering, architectural and construction work. In the section devoted to signal and safety devices no less than 500 devices designed to insure the safety of the traveling public are exhibited. An electrically operated interlocking plant and two mechanical plants are erected and can be operated in connection with a complete track layout, switches, signals, etc., without. This is similar to the railroad exhibit of the German government at the St. Louis Exposition in 1904. In addition, an electropneumatic interlocking plant and a number of block signal installations in full size, as well as in miniature, are

shown. Many of them can be operated, and they are equipped with telegraphic and telephonic apparatus connected with other parts of the system, in order to show the mutual relation of each to the whole. Electric alarms, all apparatus used by the station master, and block signals for single and double tracks are placed ready for operation. Old and new types show the considerable development of these devices.

In the section devoted to the application of electricity as a motive power many gifts have been received from the two leading electrical firms of Germany. This section shows the development of electrical apparatus from the earliest beginnings. A large picture on the wall shows the first electric train, which was operated in 1876 during the Berlin Exposition. The exhibit includes full-sized controllers, rail joints, overhead wires, insulators, track switches, underground conduits, motors, etc. The chief attraction is a model, one-tenth size, of the high-speed car which exceeded 200 kilometres per hour during the 1903 trials on the Berlin-Zossen road. There is also shown the first practical single-phase motor ever built. There are sections devoted to rail manufacture, roadbed development, locomotive and car construction, shop and mechanical appliances, railroad management and welfare work.

Exposition at Seattle in 1909.

With characteristic energy the management of the Alaska-Yukon-Pacific Exposition, which is to be held at Seattle, Wash., from June 1 to October 15, 1909, has already completed many of its plans, and active operations have been begun. On June 1, with appropriate ceremonies, ground was broken on the site of the forthcoming exposition, and during the next two years every effort is to be made to have the great undertaking complete in every particular.

The idea of holding an exposition at Seattle was first suggested about two years ago, and the exposition corporation organized on May 8, 1906, while the offices of the exposition were formally opened June 1 of the same year. The campus of the University of Washington was selected as the site of the proposed world's fair on June 22, and on October 2, in a single day, the people of Seattle responded to the call for subscriptions to the capital stock of the enterprise, then fixed at $500,000, by over-subscribing this amount to the extent of $150,000. The preliminary plan of the exposition was adopted on November 5, and from that time until the present the selection of sites for the principal buildings, planning of the grounds and exposition structures, etc., have gone forward rapidly.

On January 1 of the present year commissioners were sent to every state in the American union to secure their participation. The state of Washington, in whic the exposition is to be held, was natural the first to respond, appropriating $1,000,000 for the purpose. Oregon and California, the other two Pacific states, have already made appropriations of $100,000 each; Pennsylvania has appropriated $75,000, while Missouri and Utah have also already made appropriations. Congress has not yet enacted the bill which was introduced at the last session, and which passed the Senate but not the House, appropriating $700,000 for this exposition, and it is now proposed that the new bill to be introduced at the next session shall provide for an expenditure of more than $1,000,000 for the exhibits and buildings of the general government, Alaska, Hawaii and the Philippines. Altogether, at the present time more than $2,000,000 have been raised and are available for exposition purposes, and this total is likely to be more than doubled by government and state appropriations during the next few months.

One of the most important results of the proposed exposition will be to direct the attention of the commercial world to Alaska, a region the resources of which have been somewhat overlooked. The United States government paid $7,200,000 for this region of nearly 600,000 square miles, thirty-nine years ago. It has proved a good investment, since Alaska has produced $125,000,000 in gold, $80,000,000 in furs, and $95,000,000 in fish, and has yielded in revenue to the government alone no less than $11,000,000. Its mineral resources have as yet hardly been scratched, while it forms one of the world's most important timber regions at the present time. Immense areas are also suitable for agriculture, and it is likely that during the next two or three decades the population, wealth and commercial importance of this immense territory will increase several fold.

This bringing together of the shores of the Pacific in trade will be made possible by exhibits of the products of each. The foreign exhibits at the Alaska-Yukon-Pacific Exposition will be confined strictly to the products of countries bordering on the Pacific Ocean. Participation will be invited from Australia, Canada, Ceylon, Chili, China, Colombia, Costa Rica, Ecuador, Formosa, Korea, French East Indies, German Colonies, Guatemala, Honduras, British India, Japan, Mexico, Dutch East Indies, Nicaragua, New Zealand, Panama, Peru, Philippine Islands, Straits Settlements, Siam and Salvador. In addition to the foregoing the United States, Great Britain, France, Germany, Russia and the Netherlands will be invited to make exhibits representative of their interest in Pacific trade development. It will be the plan of the exposition, as far as practicable, to induce the foreign nations that participate to erect their own buildings and install therein collective and competitive exhibits.

The exposition site, which is 255 acres in extent, borders for more than a mile and a half on Lake Union and Lake Washington, the latter being the largest body of fresh water in the Pacific Northwest, and is within the city limits of Seattle, being only twenty minutes' ride by electric car from the business centre.—*Bulletin of the American Association of Commerce and Trade in Berlin, Germany, September* 15.

Technical Publicity Association.

The Technical Publicity Association devoted the first meeting of the year, September 26, to the consideration of "The Mailing List." N. W. Gage, of the "Buyers' Reference," and Burdette Phillips, of the "Central Station List" and "Electric Railway Directory," addressed the association and a long discussion followed in which various members told their experiences in making and using mailing lists, and in some instances compared this form of advertising with trade magazine advertising.

It was decided to take up other phases of this broad subject at the October meeting of the association.

Power by Wireless.

Newspaper dispatches announce that a young Lyons, France, scientist asserts that he has discovered a means of transmitting electrical energy without wires. Experiments have been proceeding at the home of a Lyons manufacturer named Auguste Villy. A miniature car running on rails was recently propelled a distance of 200 yards by means of power from an electric transmitter. Details of the process are withheld, but it is said that a syndicate has been formed to work the invention.

REVIEWS OF CURRENT ENGINEERING AND SCIENTIFIC LITERATURE

The Invention of the Electric Furnace.

Without wishing to detract, in any way, from the credit due to Moissan for his admirable work in developing and utilizing the electric furnace, attention is called here to the early work of Louis Clerc, who devised and patented an electric furnace in 1881. This work was done in an endeavor to manufacture a refractory material which might be used in a lamp, known as the "Soleil," the principle of which was similar to that of the calcium light. As no natural material could be found which would stand the intense heat of the electric arc, Clerc endeavored to make a substance which would meet the requirements. In this he was, of course, unsuccessful and the lamp was eventually abandoned. The work which he did on the electric furnace is interesting, however. Clerc tried two sources of intense heat, the electric arc and the oxyhydrogen flame. He also proposed using the two simultaneously in the hope of reaching still higher temperatures. The furnace consisted of a block of refractory material, such as a mixture of a metallic oxide and calcined magnesia, hollowed out and covered with a lid of similar material, through which the substance to be treated could be introduced. The cavity might be of any form, though spherical was preferred. The electrodes were introduced at the sides, or if the oxyhydrogen was used, two or more burners were inserted from the sides. As many electrodes as were desired might be employed with the electric type, and these could draw their current, in pairs, from independent sources. Springs were used to advance the carbons as they were burned away and it was suggested that the oxygen and hydrogen gases might be introduced through passages in the electrodes.—*Translated and abstracted from L'Industrie Electrique (Paris), September* 10.

Hydraulic Power in France.

A general discussion is given here of the hydraulic developments in France and of the power sites as yet undeveloped. Fuel is scarce in that country, a condition which increases the value of its waterfalls. It is estimated that the total power developed by steam engines in France, at the present time, is 8,900,000 horse-power, of which 6,700,000 horse-power is employed on the railroads, leaving 2,100,000 horse-power for industrial undertakings of various kinds and 100,000 horse-power for inland navigation. These figures are for the nominal horse-power. Allowing eighteen hours' operation a day for the stationary engines, a high margin, eight hours for the railways and twelve hours for engines employed in inland navigation, it appears that 34,000,000,000 effective horse-power hours are utilized during a year, which corresponds to continuous operation at the rate of 3,860,000 horse-power. This is the field which may be supplied by hydraulic development. The water powers of France have not been gauged with very great accuracy, so that the total hydraulic power available is not really known. The country, however, is favored in the matter of water courses and waterfalls. On the non-navigable rivers throughout France there are at present 46,000 hydraulic installations of all kinds, the total available power of which is 500,000 horse-power. On the navigable rivers there are 1,500 such installations with a total of 80,000 horse-power. The small average of these plants is due to the large number of old water-wheels still running. Much hydraulic power, however, remains undeveloped. In the Higher Alps Department a total of 300,000 can be obtained during the dry season and 500,000 during the wet season. The corresponding figures for Savoy are 320,000 and 650,000 horse-power, and for the Maritime Alps, 70,000 and 140,000 horse-power. It is estimated that the whole region between the Alps and the Rhone would yield 3,000,000 horse-power during the dry season and 5,000,000 during the wet. In the departments adjoining the Pyrenees 1,300,000 horse-power is available during the dry season, and in the central section there is 900,000. In the other departments of France the total available power is estimated at 1,400,000 horse-power. The total hydraulic power for France is said to be between 9,000,000 and 10,000,000 horse-power.—*Abstracted from Engineering (London), September* 13.

Two New Methods of Operating Railways by Alternating Currents.

The first method of driving, which is described here by G. Sahulka, has been devised for applying alternating-current motors to railways, the particular type of motor employed being the induction motor which is normally a constant-speed machine. To obtain the desired variable speed, both elements of the motor are mounted so as to be rotatable and the absolute speeds of the elements are varied without changing their relative speeds. This is accomplished by attaching one element, say the inner, rigidly to the axle which drives the car and also mounting on this axle a direct-current motor of smaller size. The outer element of the induction motor is then mounted on a quill carried on the same axle and drives through gears a direct-current dynamo. This dynamo is also smaller than the induction motor and it supplies current to the direct-current motor on the driving axle. By controlling the potential of this dynamo, any speed of the driving axle may be obtained without much affecting the relative speeds of the induction motor elements and without much change in the efficiency of the driving system. At high speeds the greater part of the driving power is obtained directly from the induction motor. At lower speeds it is obtained indirectly through the direct-current system. This system differs in this respect from other motor-generator systems, since the main motor supplies part of the driving power directly, and also in the size of the direct-current generator and motor, each of which need be only about half the size of the main motor. To start the main motor the ordinary starting resistance may be employed, but these also may be small, as the motor need not start under heavy load. The second method proposed also makes use of a three-phase induction motor, utilizing this, however, as a potential transformer and a frequency changer. The motor has a definite two-phase winding and is started in the usual way on resistances. After it has reached full speed, low-potential, low-frequency currents are drawn from the rotor and supplied to two single-phase commutator motors. By varying

the current taken by these motors, the speed of the car may be controlled.—*Translated and abstracted from Elektrotechnische Zeitschift (Berlin), August 29.*

A Suggestion for the Improvement of the Small Power Load.

There are two ways in which a supply company can increase its sale of current. These, according to H. S. Hatfield, are first by getting new customers, and second by persuading the present customers to take more current. The second is thought to be the easier and the more profitable way. The private lighting customer in England at present avails himself to but a very small extent of the offer of cheap power. The objection is that the supply must be separately metered, and it is necessary either to install a separate service for the purpose, or to use a sub-meter. The cost of a separate service is the great bar to the extension of the use of heating and power appliances. The sub-meter system is free from this objection and moreover the meters may be removed from one point and installed elsewhere when they are no longer needed, so that a heavy investment in instruments is not necessary. Another advantage in England is the power of the supply companies to install sub-meters, while they are not authorized to put in the extra wiring which would be required for a separate system. The sub-meter system has, however, a few objections. One is want of flexibility, since the power appliances must be installed near the meter. The second is the cost of a full-sized meter for such service. Another is the unsightliness of such an instrument in an ordinary room, and there is moreover the liability of making mistakes in reading the meters and in adjusting the accounts. Another trouble would be to adapt the sub-meter system to those customers supplied on the demand indicator system. To overcome these objections, a special type of meter has been devised, which is here described by Mr. Hatfield. This is a small mercury electrolytic meter adapted to be installed on any outlet. A special receptacle on this instrument is used to supply the current to the heating apparatus or meter, while an ordinary outlet enables the circuit to be run to a lamp. The form of service only is metered. These meters are small and inconspicuous. They do not cut out the lamp where they are installed, and can be put in place at little expense.—*Abstracted from the Electrician (London), September 13.*

Power as a National Problem.

One of the features of recent legislation by the nations has been the determination of the conditions under which national power resources may be utilized in their application to industrial processes. A very striking illustration of this question is that centering at Niagara Falls, where it is desired to preserve the natural beauty of the falls, and yet the value of this water power as an asset is well appreciated. Incidentally, questions come up of the extent to which power may be produced by the subjects of one country, in this case Canada, and transmitted to factories on territory under an entirely different government. A more recent example is a proposal of the Norwegian government passed lately by the Storthing and ratified by the council of state, restricting leases or sales of electric power to foreigners. A temporary act passed in June, 1906, concerning the right of acquisition, working of mines, waterfalls and forests, has been extended until April 1, 1908, when it will be supplemented by another act specifying the regulations which are going into effect and which will put a considerable amount of difficulty in the way of exploitation by foreigners of these Norwegian resources. These two instances indicate that a new factor in imperial politics is rapidly approaching a dominant position. In the past the command of the sea, the opening of new markets and the exploitation of barbarous countries have created situations of imperial policy which have had to be decided either by diplomatic conference or resort to arms. The feature of the twentieth century in national policies will probably be the disposition of national power resources. The author then endeavors to foresee what would be the effect of the power development at Niagara Falls on the industries of this country and Canada. He points out the population within 700 miles of Niagara Falls was nearly 57,000,000 when the last census was taken. The centre of the population is only 230 miles southwest of the falls. For these reasons, he believes that the manufacturing interests of the country would largely converge toward the falls. The position at present is that Canada and the United States share the advantages of water power at the falls, and reciprocate in the production and distribution of electricity derived from the falls. American citizens are dependent upon the proper performance of Canadian power companies, and this point has been the subject of restrictive legislation in recent times, this legislation in itself limiting the future expansion of electric power utilization in the district. The complexity of the arrangement is bad enough even at present when the two countries are in amicable relationship. What would happen to the manufacturers in that area were diplomatic relations ruptured between the two nationalities, it is hard to conceive. Certain it is that ruin would face many industries at present living on good profits. Another form of natural power is the oil supplies, and the utilization of these will be much larger in the future. The control and development of these resources is a serious problem in certain countries, such as Russia, where the situation at the present time is very disorganized. The chief power resource in England is coal, as the water powers there are of little moment. At the present time, the coal producers are exporting coal in large quantities, but fortunately it seems that these resources are almost inexhaustible. The great power problem at present attracting attention in England is that of producing electricity in large quantity and supplying this over large areas at low rates. There is no danger that the supply will be curtailed through natural causes for many years to come, and the opportunity for Great Britain at the present time is to utilize these cheap sources of power in developing her manufacturing industries. In Germany the situation is rather peculiar, since German syndicates prefer to buy Welsh coal rather than develop their native resources. Any other government would encourage the development of its mines. After thus covering the field, the author decides that for the immediate future England holds the unique position. Norway, which could be the most formidable rival, has handicapped herself by legislation. America and Russia are not in a state of complete political and financial stability. It is confidently expected that the northeastern counties of England will, in the near future, develop into the focus of electrochemical and other industries which require for their operation the use of cheap power. The recent establishment in that section of several electrochemical and metallurgical industries seem to be omens of the future. —*Abstracted from the Electrical Review (London), September 13.*

INDUSTRIAL SECTION

ILLUSTRATED DESCRIPTIONS OF NEW AND STANDARD ELECTRICAL AND MECHANICAL APPARATUS

A Balanced Automatic Engine Governor.

The single-spring balanced governor used on American-Ball engines brings about a regulation as close as one-eighteenth of one per cent total departure from normal speed with the whole load suddenly thrown on or off. This regulation has been secured with regularity, and the builder of these engines guarantees a maximum departure under extreme service conditions of one per cent. It might seem futile to spend time and money in attempting to improve on a governor which will give regulation as close as this, but one of the important features of the apparatus designed and manufactured by the American Engine Company, Bound Brook, N. J., is efficiency over long periods of time. In order to produce a governor which would not only regulate closely upon test, but would continue to regulate at this point, the company has devoted several years of experimentation to the design of a new form of spring-balanced governor.

One of the principal defects of the single-spring balanced governor has been the tendency for the moving weight to swing outward and inward during the revolution of the flywheel and cause a slight hunting or pumping effect.

In the earliest types of American-Ball engines this defect of single-weight governors was corrected by the adoption of the two-weight system illustrated in Fig. 1. This design, without substantial change, is that which has been in use on the American-Ball engines for many years, and which has produced in some cases the remarkably small speed variation of one-eighteenth of one per cent under the most extreme conditions of shifting loads.

As shown, the governor comprises two pivoted masses linked together, whose rotative motion is opposed by a single radial spring. The gravity of each mass completely balances the gravity of the other in all positions of the flywheel, so that this design exhibited no tendency toward "pumping" or pounding even on very low speeds. However, the bellying of the single spring from centrifugal force does produce a certain amount of deformity from the normal and a certain amount of wear.

In the latest design, indicated in Fig. 2, the relation of the parts is as follows: A—valve-actuating stud; B—eccentric pin-carrier; C—eccentric pin-carrier bushing; D—governor weight; E—governor link; F—radial spring; G—tangential spring; H—knife-edge; I—stop; J—eccentric rod; K—governor eye-bolt.

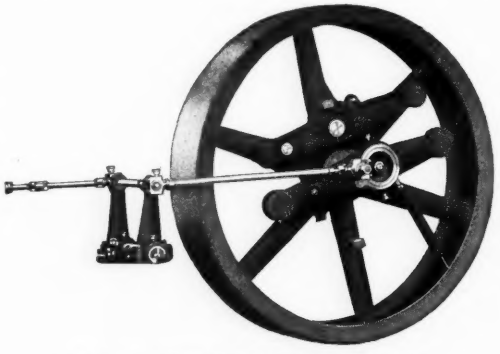


FIG. 1.—AMERICAN-BALL TWO-WEIGHT GOVERNOR.

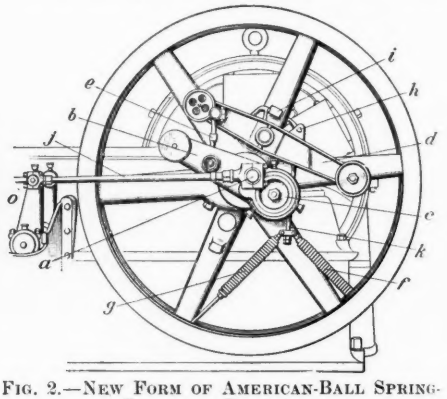


FIG. 2.—NEW FORM OF AMERICAN-BALL SPRING-BALANCED GOVERNOR.

Referring to Fig. 2 and Fig. 3, it will be seen that in the improved design, the centre-pivoted mass, or eccentric pin-carrier, as it is called, is shorter than in the original type. It was found by experimentation that this extra mass could be dispensed with by slightly changing the proportions of the other members with advantage. The second apparent change is in the spring arrangement, where two springs, tangentially and radially arranged, are substituted for the single spring.

A two-weight system is employed to secure a governing effect, the rotative pull being the combined effect of angular inertia and centrifugal force, with the complete elimination of gravity forces as affecting in any way the behavior of the system. A centrifugal pull, varying with the speed, is produced by means of the eccentrically pivoted governor or weight arm, and secures gravity balance for the

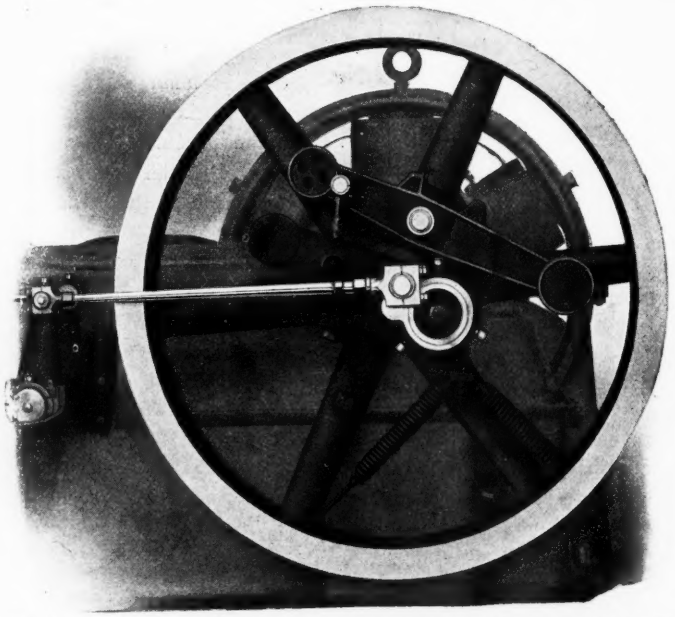


FIG. 3.—NEW SPRING-BALANCED GOVERNOR APPLIED TO AMERICAN-BALL ENGINE.

system by linking this outer arm with the concentrically pivoted eccentric pin-carrier.

An entirely novel feature of the present American-Ball governor is the peculiar arrangement of the springs. Where a single spring is used (as was the case in the governor made by the American Engine Company up to comparatively recently—see Fig. 1) the centrifugal force and gravity of the spring disturbs the functional balance of the system.

By dividing the spring force into two springs acting at right angles to each other, one tangential, the other radial, a resultant spring effect is obtained, acting in direct line with the governor eyebolt and knife-edge. This arrangement suppresses swinging or pumping and causes the spring arm and centrifugal arm to shorten together as the engine tends to speed up, maintaining a constant proportion between the two, hence a constant speed. At each stage of a revolution, the errors of swing and tension variation normally incident to one spring, are corrected by the other, maintaining a balance, which, apart from other advantages, reduces the wear on the knife-edge.

Another important advantage of this arrangement of springs is that slackening one spring and tightening the other affords means of making refined adjustments by changing the initial tension of the spring system. The range of such adjustments may be increased by varying the relative strength of the springs, not only by setting up or slacking off, but by actual substitution of stronger or lighter springs as the requirements of the case may direct.

If in testing the governor, the engine speed is found to fall off too much, the radial spring is made weaker; if the speed increases unduly, the tangential spring is made weaker than the radial spring. Thus, governing elements are secured which do not get out of adjustment even after long usage, because wear is reduced to a minimum and the system's members are mutually corrective in their opposing tendencies.

Some months ago the American Engine Company, of Bound Brook, N. J., was granted very complete patent protection on the new self-contained governor, with which it, after thorough test, equips all its engines. Experience and observation have shown that the governor will remain in adjustment for effective functioning for more than eighteen months after setting, keeping the speed regulation well within one per cent under severe fluctuations of load.

Iron-Clad Portable Measuring Instruments.

The General Electric Company, Schenectady, N. Y., is offering a new line of iron-clad portable measuring instruments of a quality that will meet the requirements of the most exacting service.

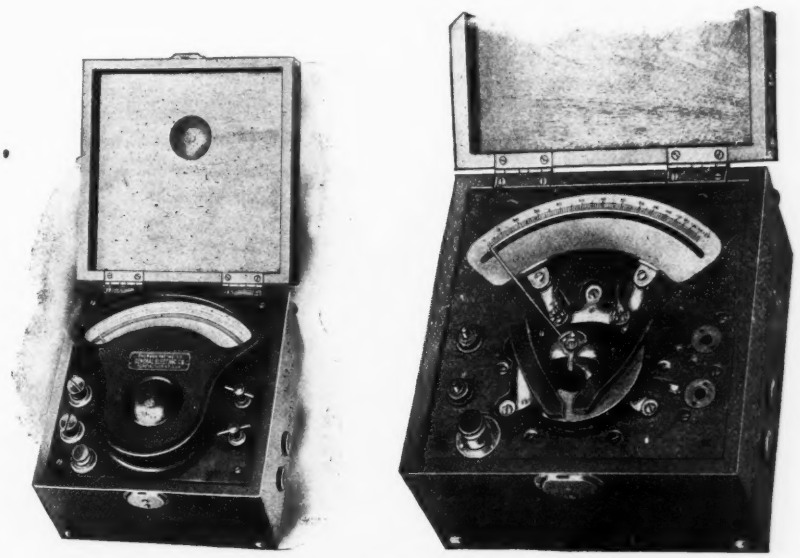
The voltmeters and wattmeters are constructed on the direct-reading dynamometer principle, while in the ammeters the Thomson inclined coil principle is applied. Mechanically these instruments are substantial in construction, with light-weight moving element, not susceptible to injury in transportation. The coils of these type P-3 instruments are entirely surrounded by a laminated iron shield which thoroughly protects them from the influence of external magnetic fields. One of the severest tests of the reliability of these instruments when used for laboratory or general testing purposes is their ability to give accurate indications when used in the vicinity of external magnetic fields.

The instruments are excellent in mechanical construction, are neat in appearance and very substantial. They are contained in wooden carrying cases provided with hinged cover and snap lock. By the removal of the internal molded cover and three additional screws, the entire mechanism can be taken from the case. The binding posts are brought out at the top of the instrument and are provided with suitable thumb-screws for securing the leads which connect the instrument to external circuit.

The type P-3 instruments may be used on circuits of any frequency, wave-form or power-factor without appreciable error. The voltmeter and wattmeter may be used interchangeably on direct or alternating current. The ammeter, although primarily an alternating-current instrument, may also be used on direct-current circuits by taking reverse readings.

The scales of type P-3 instruments subtend an arc of approximately ninety degrees and are very legible, as may be noted by reference to the accompanying illustration.

As portable instruments must first of all be accurate and capable of retaining this accuracy in service, special attention in design details has been devoted to this feature. Careful attention has been given to the construction of the jewels and pivots, as these have great influence upon the continual accuracy of indicating instruments. The pivots are made from the best grade of steel, specially hardened and highly polished, and are suspended in high-grade sapphire jewels which are practically indestructible. The pointer fluctuations are damped by means of Foucault currents set up in a thin aluminum segment which is attached to the shaft and oscillates with each movement of the pointer in the field of two astatically arranged permanent magnets. The weight of this segment balances the weight of the pointer, thereby maintaining equilibrium without extra counterweights.



NEW GENERAL ELECTRIC IRON-CLAD PORTABLE MEASURING INSTRUMENTS.

Type P-3 ammeters are made self-contained in capacities up to and including thirty amperes; voltmeters up to and including 750 volts and single-phase wattmeters in capacities up to and including thirty amperes and 750 volts.

A New Fault-Finder.

The extensive development of the telephone industry in recent years, and the growing tendency to install the wire plant underground, have brought about an increased necessity for reliable and accurate fault-locating apparatus which could be used by men who have been trained to the practical understanding of the wire plant, but have not had the benefit of technical instruction. A fault-finder showing where the wire was open, grounded or crossed with another wire, without the necessity of the use of algebraic formulæ, is a device for which there is much use in telephone systems throughout the country.

A New Fault-Finder.

The Leeds & Northrup Company, of Philadelphia, Pa., has for years been manufacturing fault-locating apparatus. Cooperating with many practical wire chiefs and skilled telephone engineers, this company has developed a fault-finder which fills the practical requirements of reliability, simplicity, rapidity of application and accuracy in indication.

The appearance of the apparatus is well shown in the accompanying illustration. The size of the box, complete with the contained battery, is six and one-half inches by eight inches by ten inches, and it weighs ten and one-half pounds. While the circular slide in the illustration might suggest a contact moving over a delicate and easily-broken slide wire, this is not the construction used. A new method on which the Leeds & Northrup Company holds United States patents enables a uniform variable slide resistance to be gotten in practically infinitesimal steps, having a resistance of not less than 100 ohms, and at the same time being so substantial as to last indefinitely.

In the cover of the apparatus are contained in unmathematical, simply expressed language and clear diagrams, instructions for making the many kinds of tests to which this apparatus is adapted. By connecting the faulty and good wires and ground to the binding posts, and setting the three switches as directed, any one without previous experience may locate a great majority of the faults and opens such as occur in telephone cables.

The directions give an arrangement by which the resistance of the conductor loop can be directly measured with accuracy. Four methods are given by which faults may be located; these faults being either grounds or crosses between the wires. Generally these methods may be used in succession for the same faults, thereby checking each other. The directions show how, by connecting to the posts a telephone and a small buzzer, the distance from the station to the point where a wire is broken may be located with simplicity and accuracy. The same apparatus can be used by a new method to measure high resistances, such as the resistance of faults. The set contains its own batteries but can be used with an outside battery not exceeding 110 volts. When such an outside battery is used, resistances of several megohms may be measured.

The simplicity of the apparatus, together with the clearness and fulness of the directions for using it, make it adaptable for the immediate use of practical men who have to work on cables.

The First Year of the Simplon Tunnel.

The Simplon tunnel was opened to regular service on June 1, 1906. The results of the first year of operation are given as follows in the Swiss *Bulletin Technique:*

The shipments have amounted to 27,400 metric tons into Italy and 29,400 tons into Switzerland, or a total of 56,800 tons carried, which includes that sent into Italy from France by way of Switzerland and *vice versa.* The traffic is very light, either because the route is new and not well known or because, with rates the same, it does not present sufficient advantages, as compared with the Mont Cenis route, to attract business. Of the traffic so obtained about 50,000 tons was destined for delivery in Switzerland or the valley of Ossola. The figures are represented as being comparatively high for the opening, for a maximum estimate of 100,000 tons had been made, based upon the traffic sent through the Simplon during the first year of its exploitation, and it is expected that these figures will be reached during the second year of operation.

The total number of passengers carried during the year can not be accurately stated as yet, but it is estimated to have been about 430,000 in the two directions.

In estimating the receipts, they are based upon the average rates of the Federation railroads, and they are placed at the gross sum of 42,000 francs per kilometre (about $13,580 per mile) for the main tunnel. It is to be noted, however, that this income of 42,000 francs per kilometre is obtained by applying, to both passengers and freight, double the rates received in 1905 by the Federation railroads, and if the Simplon rates of 8.05 centimes per ton for freight and 3.77 centimes per kilometre for passengers were to be applied the receipts would drop to 20,758 francs. This sum, therefore, represents but half the traffic that will be required before the 42,000 francs will actually be reached, so that the report of the traffic is, to a certain extent, illusory. With the actual receipts per kilometre between Brigue and Domodossola as they are, there still remains a large margin to be made up before the 50,000 francs receipts per kilometre will be reached, at which time the second track is to be laid in the tunnel.—*Railroad Gazette, September 27.*

Motor-Starters With Switches and Fuses Attached.

The accompanying illustrations show a line of motor-starters with switches and fuses attached, placed on the market by the Ward Leonard Electric Company, Bronxville, N. Y. For sizes below those requiring

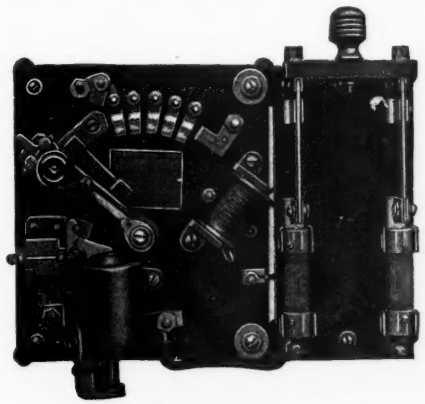


FIG. 1.—FIVE-HORSE-POWER, 125-VOLT MOTOR-STARTER.

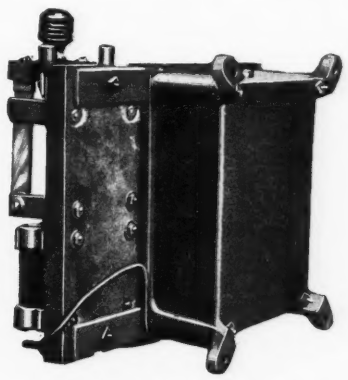


FIG. 2.—BACK VIEW OF FIVE-HORSE-POWER, 125-VOLT MOTOR-STARTER.

twenty-five ampere fuses an approved combination switch and fuse is used, with a porcelain base. In larger sizes approved, plain-finished switches and fuses are used. Fig. 1 shows a five-horse-power, 125-volt motor-starter. Fig. 2 shows a back view of Fig. 1, illustrating the method of attaching the switch and fuses. Fig. 3 shows a three-horse-power, 220-volt motor-starter. Fig. 4 shows a three-horse-power, 110-volt motor-starter with a back-mounting slate.

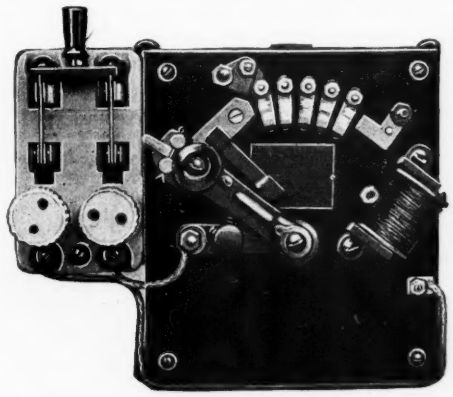


FIG. 3.—THREE-HORSE-POWER, 220-VOLT MOTOR-STARTER.

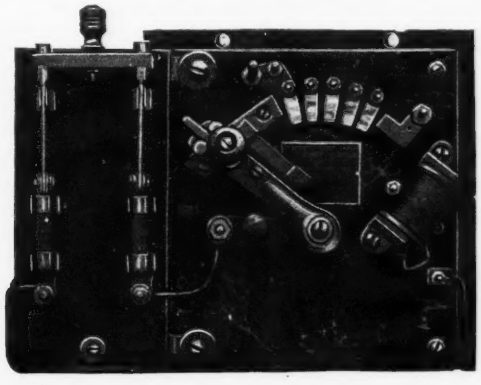


FIG. 4.—THREE-HORSE-POWER, 110-VOLT MOTOR-STARTER, WITH BACK-MOUNTING SLATE.

It is the intention of the Ward Leonard Electric Company to quote such low prices upon this apparatus that it will be found more profitable to install the combined motor-starter and switch and fuse than to install the switches and fuses separate from the rheostat, with the necessary wiring connections, etc.

A motor line switch is not closed except when the circuit is open upon the motor-starter, and this line switch is not opened except when the motor is developing high protective volts. The real closing of the motor circuit is upon the rheostat and these rheostats are equipped with circuit-closing and breaking switches. The circuit is never opened on the rheostat contacts. There is provided an auxiliary initial contact, which is a separate, removable part readily renewable, and so placed that no arc at the auxiliary contact can burn the stationary contact segments or the movable contact shoe. Supplementing the initial contact there is provided a separate, renewable, spring-actuated flipper switch, carried by the rheostat arm and connected to it by a flexible copper cable. This flipper switch breaks the arc between it and the auxiliary initial contact by a quick snap action, independent of the slowness of movement of the operator's hand.

In the case of motor-starters larger than ten horse-power the arc-rupturing parts of the initial contact are provided with magnetic blowouts.

These rheostats are of the universal type, and can be used to start any known type of direct-current motor at its rated horse-power and volts, whether series or shunt-wound, variable or fixed speed. They are fully equipped with approved switch and fuses as part of the rheostat, ready for mounting; have sufficient capacity for one-minute starting duty; are approved by the Underwriters for use in dirty or dusty places, and the resistance is enclosed and will not rust out.

Primary Battery Renewals.

Two of the important points to consider in choosing primary batteries for use on a gasolene engine are simplicity of construction and adaptability for rapid and easy renewal. In the case of the Edison primary battery the renewals are very inexpensive. The manufacturer claims that there is no deterioration of its permanent parts, and each time the battery is renewed it will last as long and deliver the same current as when it was new. When this is considered, the first cost is lost sight of in the advantage to be gained by the economical renewals. Zinc, black oxide of copper and a solution of high-grade caustic soda are the elements used in the Edison primary battery. The battery requires no attention until exhausted, unless, through carelessness, it is short-circuited.

The battery is made by the Edison Manufacturing Company, 10 Fifth avenue, New York city.

St. Paul Railroad to Electrify Bitter Root Division.

It is announced that plans are under consideration for the electrification of the Bitter Root Mountain Division of the Chicago, Milwaukee & St. Paul's extension to the Pacific Coast. The section of the line which it is planned to operate by electricity is about fifty-four miles long. It includes 8,000 feet of tunnel through the Bitter Root Mountains and the grades on both sides of the mountain.

Coming so soon after the adoption of plans by the Great Northern for the electric operation of its Cascade tunnel and approaches, and within a few days of the letting of contracts for the electrification of some of the Southern Pacific's lines in California, the St. Paul's plans are regarded as indicating the extent to which electricity is being substituted for steam power in the operation of through railroad lines.

Current Electrical News

DOMESTIC AND EXPORT.

INTERURBAN MERGER PLANNED—What is believed to be a preliminary step toward the merger of the Indiana Union Traction Company and the Illinois Traction Company has been taken by officials of the former road. The step is the extension of the latter company's line from Danville to Lafayette, Ind. The Indiana Union Traction Company of Indiana practically controls all of the interurban lines in that state. President W. B. McKinley, of the Illinois company, is quoted as saying a link that will connect the two systems probably will be commenced during the coming winter.

MERGER OF CALIFORNIA ELECTRIC LINES—A new company, to be known as the Northern Electric Railway Company, has been formed to take over the Northern Electric Company's lines and to construct an electric railroad system to cover the entire Sacramento Valley, California. Among the lines to be constructed will be one from Marysville to Meridian and to Colusa, and up the west side of the valley; and a line to Red Bluff and north to Kennet and Redding. The company will have a capital of $25,000,000. It is stated that the officers of the Northern Electric Company will fill similar positions with the new company.

NEW MEXICAN POWER COMPANY—A strong company is being organized for the purpose of establishing an electric light and power plant at Sabinas, Coahuila, Mexico. The promoters of the enterprise are Dr. Braulio Montemayor and Pablo de la Garza, who are prominently connected with a number of mining propositions. A concession has been asked for from the state government for the erection of this plant. The plant will be located in the heart of the coal district of Coahuila, and thus the question of fuel will not be such an item of expense for the new concern. As soon as the concession has been granted, active work of constructing the plant will begin.

SIXTY-MILLION-DOLLAR TELEPHONE MERGER—The consolidation of the Bell Telephone Company of Philadelphia, the Pennsylvania Telephone Company and the Chesapeake & Potomac Telephone Company, all licensees of the American Bell Telephone Company, operating in southern New Jersey, eastern Pennsylvania, Delaware, Maryland, the District of Columbia, northern Virginia and West Virginia, has been announced at the offices of the Chesapeake & Potomac Telephone Company. The companies involved have more than 300,000 telephones, but are not competitors, as they do not own parallel lines. The authorized capital stock of the new company will be $60,000,000, which is less than the combined capital and outstanding indebtedness of the old companies. The capital stock provided for is sufficient, it is asserted, to retire all of the old stock, discharge the floating indebtedness of all the companies and provide for several years' growth. The shareholders of the Philadelphia and Pennsylvania companies will receive an equal amount of the new stock for the stock surrendered, while the shareholders of the Chesapeake & Potomac company will receive two shares of the new stock for three shares of the old stock.

NEW ELECTRICAL ENTERPRISE FOR OKLAHOMA—An Oklahoma charter has been issued to the Oklahoma Central Interurban Railway, Telephone, Telegraph, Light and Power Company, which proposes to build interurban electric lines connecting practically all of the towns and cities of any importance in Oklahoma and Indian territories. The company has its headquarters at Oklahoma City and is capitalized for $5,000,000. Its main line is to run from South McAlester northwest to Cheyenne, the present county seat of Roger Mills county, passing through Holdenville, Wewoka, Shawnee, Oklahoma City, El Reno, Geary and Weatherford. The distance is 500 miles and the estimated cost of construction $17,000 per mile. Branches are also to run from McAlester north to Checotah and Muskogee; south from McAlester to Atoka and Durant; north from Holdenville to Okemah and Okmulgee; south from Wewoka to Ada; north from Shawnee to Chandler and Stillwater; south from Shawnee to Pauls Valley, Davis and Ardmore; north from Oklahoma City to Guthrie and Perry; south from Oklahoma City to Norman and Purcell; north from El Reno to Kingfisher and Enid; south from El Reno to Chickasha and west to Anadarko and Lawton; north from Geary to Watonga; north from Weatherford to Taloga; south from Weatherford to Cordell, Hobart, and Mangum, and north to Sayre and Elk City, 528 miles in all. The incorporators are: Dr. R. X. Wade, J. R. Brown, J. B. Boucher, F. M. Stone, H. H. Codington, of Weatherford; Leon Brown, of St. Louis; G. M. Watson, of Nevada, Mo.; Louis Landmann, of Jefferson City, Mo.; C. D. Freeman, of Denver, and B. I. Sharp, of Memphis.

HOLDING COMPANY FOR TEXAS ELECTRIC RAILWAYS—As a part of the plan for building the Houston-Galveston (Tex.) interurban, Stone & Webster have organized a new company known as the Galveston-Houston Electric Company. The company will acquire all of the stock of the Galveston-Houston Electric Railway Company and will have an authorized capitalization of preferred and common stock equal to the aggregate of the preferred and common stocks authorized by the two terminal companies, namely, the Houston Electric Company and the Galveston Electric Company. It will be optional with the stockholders of the two last-named companies to exchange their holdings, share for share, for stock of the Galveston-Houston Electric Company. The preferred stock of both the Galveston Electric Company and Houston Electric Company is non-cumulative, while the preferred stock of the Galveston-Houston Electric Company is cumulative. No preferred or common stock will be issued by the latter company in excess of the amount of Houston Electric Company and Galveston Electric Company stock surrendered for exchange. The Houston Electric Company has a capital stock issue of $2,000,000 common and $1,000,000 preferred, all of which is outstanding. There is also an issue of $2,500,000 first mortgage bonds bearing five per cent, of which $2,087,000 are outstanding. The Galveston Electric Company has a capital stock of $1,000,000 common and $1,000,000 preferred; all of the common and $500,000 of the preferred is outstanding. Of the $2,500,000 of five per cent first mortgage bonds only $1,000,000 have been issued. The Galveston-Houston Electric Railway Company has an authorized capital stock of $3,000,000 of which only $100,000 has been issued and has authorized a bond issue of $5,000,000 first mortgage five per cents, of which probably $2,500,000 will be issued to build the interurban. The new holding company will have an authorized capital stock of $3,000,000 common and $3,000,000 preferred (of which $1,350,000 preferred has been issued), and $3,000,000 common. Surveys have been made and considerable preliminary work has been done toward the construction of the interurban. The territory between the cities is practically level, with a stretch of open water which will have to be bridged just north of Galveston. The line will run on a private right of way, and actual construction will be begun as soon as further preliminaries have been attended to.

NEW PUBLICATION.

ANNUAL REPORT OF THE WIRE DEPARTMENT OF THE CITY OF BOSTON—The annual report of the wire department of the city of Boston, Mass., for the year 1906 has been issued by Patrick J. Kennedy, commissioner of wires. In addition to the data relative to the wire conditions in the city of Boston, there are a number of very interesting photographs showing the condition of the streets before and after the laying under ground of the wires.

OBITUARY NOTE.

MR. JAMES LANG, founder of the J. Lang Electric Company, Chicago, Ill., died in Chicago on September 10. Mr. Lang founded the company some twenty-five years ago, selling out his interest five years ago and retiring. He was eighty-four years of age at the time of his death.

ELECTRIC LIGHTING.

CANTRIL, IOWA—An electric light plant will be installed in Cantril by November 1.

RICHFORD, VT.—Plans are being considered for a new power plant costing $35,000, which may be completed by January 1.

RENO, NEV.—The Truckee General Electric Company has begun the delivery of electric power to the Yerington mining district.

GOLDFIELD, NEV.—Machinery has been ordered for an electric light plant at Mina. The plant will have a capacity of 2,500 lights.

BLOOMINGTON, ILL.—Smith & Miller, of Bloomington, have been granted a twenty-year franchise to operate an electric light plant at Manito.

NORTHFIELD, MINN.—A franchise has been granted to the Northfield Light, Heat and Power Company. An all-night service will now be maintained.

NORTH YAKIMA, WASH.—The new power plant of the Northwest Light and Power Company, about twelve miles from this city, has been formally opened.

WOMELSDORF, PA.—At a special meeting of the town council Adam M. Lengel was awarded the contract to erect the new power building for the electric light plant.

JACKSON, KY.—The repairs recently begun on the Jackson electric light plant have been completed and the plant started up by a new company, after having been idle for three years.

BIWABIK, MINN.—The contract for the new electric light plant has been awarded to the Burgess Electric company for $4,000. The plant will be installed at the Biwabik mine shops.

ASHDOWN, ARK.—T. C. Aubrey, of Verda, La., is interested in the organization of a company here to install a light and ice plant. It is expected the plant will be ready for use by next March.

ALVIN, TEX.—At a regular meeting of the city council a resolution was passed authorizing the mayor to buy four 1,000-candle-power street lamps for lighting the business portion of the city.

ROCKFORD, ILL.—W. H. Poulton and W. W. Mackay, of Cherry Valley, have closed a deal by which they become owners of the Cherry Valley mills and electric light plant. The new owners intend to install new machinery.

MIDDLETOWN, CT.—In their third annual report the Middletown gas and electrical commissioners state that the net profit for the year as shown by the schedules was $22,632.12, after charging off for depreciation $13,582.99.

BERLIN, MD.—Berlin has decided, by popular vote, to grant a franchise for water and electric lights, the town to have the option of purchasing the plant at the end of five, ten, fifteen or twenty years at a price to be fixed by a committee.

ATLANTIC CITY, N. J.—Members of the city council, headed by Chairman Donnelly, of the lighting board, have come out in favor of spending the $30,000 necessary to carry out the decorative lighting of Atlantic avenue, outlined by Carrere & Hastings.

PROVIDENCE, R. I.—Stone & Webster, of Boston, Mass., have taken over the management of the Woonsocket Electric Machine and Power Company. Thomas Nickerson, the local manager at Woonsocket, says that plans are now well under way for extensive improvements.

ALBANY, N. Y.—The up-state public service commission has received notice of a voluntary reduction in the price of electric light in Tonawanda. The Tonawanda Power Company has reduced the price per arc lamp per year to the municipality from $70 to $57.50.

MADISON, WIS.—The state railway commission has handed down a decision permitting the Madison Gas and Electric Company to raise its rates. The commission finds that the present rate is too low. The evidence showed that the company is losing $2,500 per month.

STONINGTON, CT.—The Westerly Electric Light Company has purchased land on Williams street on which a substation will be erected at once. The poles necessary for the extension of the line from Westerly are in place and the wire will be strung immediately.

ELDORA, IOWA—At a meeting of the borough council of Wharton a five-year contract was made with the Dover Electric Light Company by which Wharton is to be supplied with seventy-five lights of twenty-five candle-power, at $20 per year for each light, a total of $1,500 per annum.

HUNTINGTON, IND.—Patrons of the electric light department of the Huntington Light and Fuel Company have been notified of a reduction in the minimum rate from $1 to fifty cents a month. The present rate is twenty-five cents per 1,000 watts, four thousand being the minimum charged for.

ESSEX, CT.—The Essex Light and Power Company has been purchased by George L. Cheney and Mrs. William G. Seeley, and William A. Brothwell, of Chester. The following are the officers: president, George L. Cheney; secretary and treasurer, George L. Sleeper; superintendent, E. N. Frary.

ATLANTA, GA.—A charter has been granted by the secretary of state to the Americus Railway and Light Company. The company proposes to operate a street railway and electric light and power plant in Americus. Its capital stock is $250,000. Congressman E. B. Lewis, of the third district, W. A. Dodson, of Americus, and others are the incorporators.

LOWELL, IND.—The town of Lowell has sold the electric light plant to N. C. Wiley, of the Wiley Brothers Construction Company, Chicago. The plant will be operated by a company to be called the Lowell Light and Power Company, a twenty-five-year franchise having been granted to Mr. Wiley. It is announced that a new plant will be constructed at a cost of $50,000.

RENO, NEV.—Ground has been broken for the 220-mile power line which the Nevada-California electric company will build from Pickle Meadows, seventeen miles from Bishop, Cal., to Manhattan, Tonopah and other southern camps. The power line will be completed and in operation within three months, and within a year, it is announced, the power from Pickle Meadows will be sold in Reno, Yerington and other towns in western Nevada.

CASPER, WYO.—The Casper Electric Company has been sold to Nathan C. Johnson and Senator Patrick Sullivan. The former owners were C. H. King, Theodore Becker and Dr. F. Salathe. Senator Sullivan is the new president of the company and Mr. Johnson is the treasurer and manager. Mr. Johnson has been the manager for the last year. The name of the company has been changed to the Casper Electric Light and Power Company.

SCRANTON, PA.—The Scranton Electric Light Company has given out an announcement in regard to the $10,000,000 bond issue authorized recently. It is the intention of the company to spend the money in the next thirty years in the improvement of its property, and to meet the growing needs of the city. An order issued by the board of directors grants the local office the use of $1,254,000. Of this $750,000 will be used in the redeeming of bonds, and the remainder spent in the improvement of the property.

LONG BRANCH, N. J.—The Consolidated Gas Company of New Jersey has been granted a ten-year contract by the city council to light the city of Long Branch. The Consolidated company agrees to furnish arc lights for the first five years at $80 each and for the next five years at $79 each. In all about 200 arc lights will be used. The present contract for arc lights is $82 per year, with a flat figure of $3,386 for lighting the bluff walk. The difference between the present contract and the new one shows a saving to the city of $2,100 a year.

GLENS FALLS, N. Y.—The annual meeting of the stockholders of the Granville Electric and Gas Company was held in Granville. The old directors were reelected as follows: B. G. Higley, Sandy Hill; George Tait, Glens Falls; Edgar T. Brackett, Saratoga Springs; F. D. Howland, Sandy Hill; E. R. Norton, F. T. Pember, H. J. Stevens, F. C. Sheldon, F. S. Fogg, Granville. The directors reelected the old officers as follows: president, B. G. Higley; vice-presidents, F. T. Pember, George Tait; treasurer, H. J. Stevens; F. S. Fogg, secretary and general manager.

KINGSTON, N. Y.—Plans for utilizing the Plattekill stream as power for a large electric plant at Newburgh are almost completed.

The sum of $500,000 is to be spent on the project, which will be carried out as soon as possible. The plan is to divert the waters of the Plattekill and the Orange Lake streams into a new channel and construct three reservoirs and power-houses with a total capacity of 1,500 horse-power. The sale of this power for commercial purposes, together with the extensive land development, is expected to net an income justifying the big expenditure.

WASHINGTON, D. C.—Plans developed for lighting the new Union passenger station and terminals in Washington contemplate the use of 480 500-watt arc lamps, 500 high-efficiency lamps and about 3,600 sixteen-candle-power incandescent lamps. To light the pipe and wire tunnels between the power plant and the station and express building requires 190 incandescent lamps, or one every ten feet. To care for the wires used in this great lighting system requires the installation of about 88,000 feet of conduit of various sizes in the station and about 68,000 feet in the express building, power plant and K street signal tower and about 12,000 feet in the train sheds. In addition to the lighting conduits about 20,000 feet of conduits are required for the telegraph and telephone wires at the station and about 12,000 feet at the express building, power-house and K street signal tower.

NEW INCORPORATIONS.

LITTLE ROCK, ARK.—Van Buren Fuel and Light Company. $25,000. James Brizzolara, state agent.

ALBANY, N. Y.—The Sutepec Electric Light and Power Company, of Brooklyn. Capital stock increased from $200,000 to $300,000.

SPRINGFIELD, ILL.—Panola Independent Telephone Company, El Paso. $525. Incorporators: Joseph Haas, James Bailey, William Burroughs.

MADISON, WIS.—The Poynette Telephone Company, Columbia county. $10,000. Incorporators: E. E. Hinkson, J. S. Hinkson and H. P. Jamieson.

BELLINGHAM, WASH.—Blaine Water and Power Company. $50,000. Directors: H. L. Jenkins, Seattle; J. R. Crites, Bellingham; J. S. Crilly and W. J. Gillespie, Blaine.

SPRINGFIELD, ILL.—The Clayton Farmers' Union Telephone Company, Clayton. To operate a telephone system. $1,000. Incorporators: John W. Wallace, Charles C. Cain and Henry J. Beckham, Sr.

DENVER, COL.—Larimer & Routt County Railway Company, of Walden, Larimer county. To build a road through the North Park county. $1,000,000. Incorporators: Isaac Van Horn, M. T. Dickinson, L. W. Thompson, G. M. Colby, E. S. Crawley.

LEGAL NOTES.

THE EICKEMEYER SQUIRREL-CAGE WINDING CASE—In the suit of the General Electric Company, complainant, *versus* Corliss-Coon & Company, defendants, involving patent No. 677,308, District Judge Ray filed an opinion in the United States Circuit Court, Northern District of New York, on July 9, holding that the claims in issue are valid and infringed by the defendants.

DOVE-TAILED LAMINÆ CASE—In the suit of the General Electric Company *versus* the Bullock Electric Manufacturing Company in equity on final hearing on pleadings and proof before the United States Circuit Court, District of New Jersey, Judge Lanning filed an opinion on August 12, holding that the complainant is entitled to a decree, adjudging the defendant an infringer of claim 2 of the Morrow patent, but not of the Reist patent. This suit involved the Morrow patent No. 504,401 and the Reist patent No. 559,910, each for an armature for dynamoelectric machines.

LAMINATED POLE CASE—In the suit of the General Electric Company, complainant, *versus* the city of Nashville (Tenn.), defendant, in the laminated pole case involving Parcelle patent No. 463,704, Judge Clark filed an opinion in the United States Circuit Court for the Middle District of Tennessee on August 26, decreeing a preliminary injunction enjoining the city of Nashville from using any of the electric motors and dynamos described and claimed in the said letters-patent. The city of Nashville was given sixty days from the date of the entering of the decree, August 28, in which to make proper provisions for carrying on its business with the use of apparatus other than that specified in the complaint.

PERSONAL MENTION.

MR. E. J. CARLSON has been made manager of the Western Union Telegraph Company's Bellingham, Wash., office, succeeding E. Parlan, who has been transferred to a post in California.

MR. A. N. FOX, manager of the department of publicity of the Benjamin Electric Manufacturing Company, Chicago, Ill., has returned to Chicago from an extended business and pleasure trip through the western states. Mr. Fox reports business very good in that part of the country.

MR. J. E. HAM, formerly of the Hazard Manufacturing Company, has been appointed representative of the Waterbury Company, New York city, for the introduction of its high-grade insulated wires and cables. Mr. Ham's headquarters will be in the Waterbury Company's branch office, 108 La Salle street (Stock Exchange Building), Chicago, Ill.

MR. WILLIAM COALE, treasurer of the Sterling Electrical Manufacturing Company, Warren, Ohio, and Colonel Ramey, of the same company, were Chicago visitors last week. Among other electrical men visiting that city at the same time were W. N. Matthews, of W. N. Matthews & Brother, St. Louis, Mo.; C. H. Johnson, vice-president of the Curtis Advertising Company, Detroit, Mich., and Charles G. Burton, manager of the Peru Electric Manufacturing Company, Peru, Ind.

MR. ARTHUR S. MERRILL, who has been identified with the electrical trade for the past ten years, most of the time in New York city, and more recently as assistant western sales agent for Pass & Seymour, Incorporated, Solvay, N. Y., with headquarters at 130 West Jackson Boulevard, Chicago, Ill., has tendered his resignation. Mr. Merrill will devote his time to carrying out some plans upon which he has been working for some time. He is a brother of William W. Merrill, secretary of the Chicago Fuse Wire and Manufacturing Company.

MR. W. E. MOORE, general manager of the West Penn Railways Company, with headquarters at Connellsville, Pa., has been transferred to Pittsburg. In addition to his duties as general manager of the West Penn system, Mr. Moore will hold a consulting position in connection with the many other interests, including a large water power development in Idaho, in which W. S. Kuhn, president of the company, and his associates, are interested. George Folds, of Chicago, Ill., has been appointed assistant manager of the West Penn Railways Company, with headquarters at Connellsville. Mr. Folds will begin his duties November 1.

MR. PERCY H. THOMAS, the well-known electrical engineer, has resigned from the Westinghouse interests to join forces with N. J. Neall, consulting engineer, of Boston, Mass., to form the firm of Thomas & Neall, electrical engineers, with offices in New York and Boston. The firm expects to do general consulting work in electrical engineering, giving special attention to high-tension transmission design, to the investigation of the difficulties in operation with high voltage, to lightning protection, and to extra-high-tension practice. While connected with the Westinghouse Electric and Manufacturing Company, both Mr. Thomas and Mr. Neall did a large amount of investigation work on high-tension problems in both experimental and commercial systems. Mr. Thomas was graduated from the Massachusetts Institute of Technology, and entered the employ of the Westinghouse Electric and Manufacturing Company as a student. His early work was on insulation of apparatus and on transformers, followed by a stay in Brazil in 1896 and 1897, in connection with one of the early transmission plants. He then spent some years in the investigation of static disturbances and lightning, with special reference to the protection of commercial systems. Later, as chief electrician of the Cooper Hewitt Electric Company, he carried on the practical development of the Cooper Hewitt mercury vapor apparatus. Mr. Thomas, although a very young man, has had many positions of responsibility and has contributed very generously to the literature of the American Institute of Electrical Engineers. He has been a prominent member of several important committees, and has done a lot of good work. Mr. Neall is also a graduate of the Massachusetts Institute of Technology, and has made a specialty of high-tension work. He is a well-known contributor to the technical press, and is a leader in the discussion of lightning protection and other phases of high-tension engineering in the meetings of technical societies throughout the country. He has been practicing his profession in Boston, where he opened an office in the spring of 1906.

ELECTRICAL SECURITIES.

The stock market last week was somewhat more depressed than it has been recently, and the reason for this is said to be the selling by speculators of considerable quantities of excellent securities. The issue by the New York, New Haven & Hartford Railroad Company of $32,000,000 of new eight per cent dividend-paying stock at a price of $125 a share was treated as a bear argument, and the insolvency declared by the New York City Railway Company did not help to advance the prices of securities. The western industries continue to reflect unbounded prosperity, and there is now abroad a well-founded belief that a good deal of the contraction in capital available is due to the large amount of money which is being kept in use in a rather restricted area as far as the nation is concerned.

Dividends have been declared upon the following electrical securities:

Consolidated Gas, Electric Light and Power Company, of Baltimore; semi-annual dividend of 3 per cent on preferred stock; also 3 per cent on common stock, payable October 1. Bell Telephone Company of Missouri; regular quarterly dividend of 2 per cent, payable October 1 to stock of record September 25. Rochester Railway Company; regular quarterly dividend of 1¼ per cent on the preferred stock, payable October 1. Central & South American Telegraph Company; regular quarterly dividend of 1½ per cent, payable October 9. Mexican Telegraph Company; regular quarterly dividend of 2½ per cent, payable October 16. National Light, Heat and Power Company; regular quarterly dividend of 1¼ per cent on the preferred stock, payable October 1. Macon Railway and Light Company; a dividend of 3 per cent on the preferred stock, payable October 1. Duluth-Superior Traction Company; quarterly dividend of 1 per cent on the preferred stock, payable October 1. Columbus, Newark & Zanesville Electric Railway Company; quarterly dividend of 1½ per cent on the preferred stock, payable October 1. Boston Suburban Electric Company; regular quarterly dividend of 75 cents on the preferred stock, payable October 15. Omaha & Council Bluffs Street Railway Company; quarterly dividend of 1¼ per cent on the preferred stock, payable October 15. Rockford & Interurban Railway Company; quarterly dividends of 2 per cent on the common stock and 1½ per cent on the preferred stock, payable October 1. Toronto Railway Company; regular quarterly dividend of 1½ per cent, payable October 1. Sao Paulo Tramway, Light and Power Company; regular quarterly dividend of 2 per cent, payable October 1. Syracuse Rapid Transit Company; regular quarterly dividend of 1½ per cent on the preferred stock, payable October 1. Utica & Mohawk Valley Railway Company; regular quarterly dividend of 1¼ per cent on the preferred stock, payable October 1. Public Service Corporation of New Jersey; regular quarterly dividend of 1 per cent, payable to stockholders of record September 30.

ELECTRICAL SECURITIES FOR THE WEEK ENDING SEPTEMBER 28.

New York:	*Closing.*
Allis-Chalmers common	7½
Allis-Chalmers preferred	20¼
Brooklyn Rapid Transit	42⅝
Consolidated Gas	96½
General Electric	124
Interborough-Metropolitan common	8½
Interborough-Metropolitan preferred	24½
Kings County Electric	109
Mackay Companies (Postal Telegraph and Cables) common	59¾
Mackay Companies (Postal Telegraph and Cables) preferred	60
Manhattan Elevated	114
Metropolitan Street Railway	36
New York & New Jersey Telephone	100
Western Union	72
Westinghouse Manufacturing Company	122

The annual meeting of the Allis-Chalmers Company has been again adjourned until October 23, no quorum being present.

A regular quarterly dividend of 1¾ per cent has been declared on the capital stock of the New York & New Jersey Telephone Company, payable October 15 to stockholders of record at the close of business October 5.

A quarterly dividend of 2½ per cent upon the preferred, assenting and non-assenting stocks of the Westinghouse Electric and Manufacturing Company has been declared, payable October 10 to stockholders of record October 3. The Westinghouse Electric and Manufacturing Company, based upon its report for the first five months of its current fiscal year, continues to make a favorable showing from the standpoint of surplus and net earnings. While surplus is not running as large as in the first two or three months of the company's year, the returns are satisfactory when the high cost of copper and other material that enters into the manufacture of electrical apparatus is taken into consideration. The total income for the five months ended August 31, aggregated $3,548,886, or at the rate of $709,775 a month, or $8,517,300 a year. The surplus for the five months aggregated $1,704,341, which was at the rate of $340,870 a month or $4,090,440 a year. The surplus in the five months was at the rate of 16 per cent a year on the total capitalization of the company, including all classes of stock.

Boston:	*Closing.*
American Telephone and Telegraph	106
Edison Electric Illuminating	205
Massachusetts Electric	50
New England Telephone	—
Western Telephone and Telegraph preferred	—

Philadelphia:	*Closing.*
Electric Company of America	8¾
Electric Storage Battery common	44
Electric Storage Battery preferred	44
Philadelphia Electric	7½
Philadelphia Rapid Transit	18⅝
United Gas Improvement	85

The directors of the Electric Storage Battery Company have declared a dividend of 1¼ per cent from the net earnings of the company, on both common and preferred stocks, payable October 1, 1907, to stockholders of record at the close of business on September 27.

Chicago:	*Closing.*
Chicago Telephone	—
Chicago Edison Light	135
Metropolitan Elevated preferred	58¼
National Carbon common	68
National Carbon preferred	113

The Metropolitan West Side Elevated of Chicago reports to the Warehouse Commission for the year ended June 30, 1907, as follows: Gross, $2,800,405; expenses, $1,361,990; net, $1,438,415; other incidentals, $7,938; total income, $1,446,353; charges, $1,015,643; surplus, $430,710; dividends, $130,608; surplus, $300,102. The surplus after charges is equal to 4.93 per cent on the $8,707,900 preferred stock outstanding.

NEW MANUFACTURING COMPANIES.

JACKSONVILLE, ILL.—The Southern Electric Train Bulletin Company, of Jacksonville, has been incorporated. The capital stock is $50,000. The incorporators are: Franklin A. Jennings, W. C. Duff and William S. Phillips.

NEW YORK, N. Y.—The German-American Electric Company has been incorporated to deal in electrical appliances. The capital is $100,000, and the incorporators: W. P. Leonhardt, E. Grant, New York city; A. H. Grant, Elizabeth, N. J.

ALBANY, N. Y.—A certificate of incorporation of the Eastern Flexible Conduit Company, of Brooklyn, has been filed with the state department. It is proposed to manufacture and sell flexible conduits, rubber tape and pitch tape. The capital stock is $20,000, divided into shares of $100 each, and the directors are: Eugene T. Trotter, A. P. Hinsky and S. A. Smith, of Brooklyn.

TRENTON, N. J.—The Direct Line Telephone Company, of New York, has been incorporated to manufacture telephones and telephone apparatus. The capital is $1,000,000, divided into 10,000 shares of the par value of $100. Of the capital 5,000 shares are to be six per cent preferred stock, and the remaining 5,000 shares common stock. The incorporators are: A. Koch Andrianan, San Francisco, Cal.; John A. Potter and Charles W. Smith, of New York.

DATES AHEAD.

Jamestown Tercentennial Exposition. Norfolk, Va., April 26 to November 30.

Railway Signal Association. Annual meeting, Milwaukee, Wis., October 8-10.

American Street and Interurban Railway Association. Annual meeting, Atlantic City, N. J., October 14-18.

American Electrochemical Society. Fall meeting, New York city, October 17-19.

American Association for the Advancement of Science. Chicago, Ill., December.

ELECTRIC RAILWAYS.

NEW HOLLAND, PA.—The building of a trolley line from Ephrata to Hershey, Dauphin county, or some other northern point is being agitated by the people of Ephrata and points along the proposed route.

RED BLUFF, CAL.—By an agreement which states that it must operate its road by July 1, 1908, through Los Molinas, the Northern Electric has secured a right of way through Los Molinas from the Los Molinas Land Company.

BRADFORD, N. Y.—A movement is on foot to secure a trolley line between Bradford and Eldred. Those interested are circulating a petition to be presented to the officials of the Western New York & Pennsylvania Traction Company, asking for the service.

WINDBER, PA.—The Berwind-White Coal Mining Company has been considering for some time the construction of trolley lines to connect central Windber with the various mines of the company in this section. The building of such a line will require an investment of about $85,000.

NEW YORK, N. Y.—Application for a franchise to build a trolley road from the Blackwell's Island Bridge *via* Thomson avenue and the Hoffman Boulevard to Jamaica, Rosedale, Freeport and thence to Patchogue has been made to the board of estimate by the South Shore Traction Company.

VANCOUVER, BRITISH COLUMBIA—Work on the electric line between New Westminster and Chilliwack has been started by the British Columbia Electric Railway Company. The line will give connection to all parts of the lower mainland, will be sixty-two miles long, and will cost $2,500,000. Construction will take a couple of years.

LANSING, MICH.—Articles of incorporation have been filed by the Lansing Southern Railway Company. The incorporators are Theron W. Atwood, the other officers of the Northern Construction Company, which is building the electric line between Lansing and Jackson, and the officers of the Michigan United Railway, which is to own and operate the road when completed.

MONTGOMERY, ALA.—Richard Tullis, of Montgomery, announces that he will soon begin the construction of a trolley line from Geneva to Dothan, Ala., to cost $500,000. It is his intention when this work is completed to extend the line to Union Springs, Troy, Eufalia, Clayton and Montgomery. The line from Dothan to Geneva will take in many growing towns.

EVERETT, WASH.—J. T. McChesney, of the Everett Improvement Company, and associates will soon begin the construction of a trolley line between Snohomish and Fall City, a distance of thirty-five miles. Surveys have been practically completed for the new line. The road will pass through the famous Cherry valley, which is one of the oldest settled districts on Puget Sound.

MILWAUKEE, WIS.—A movement is on foot among local capitalists and business men generally to promote an electric railway that will connect Superior with the rapidly settling portions of the country along the south shore of the lake. It is understood that the matter of building the road will be entirely apart from any existing corporation and that all the necessary capital will be subscribed locally.

SAN RAFAEL, CAL.—Ground has been broken for the construction of the new Bay company's electric railroad, which is to have its headquarters two miles east of this city. The company has raised $9,000,000 on its bonds in the East, making it possible to commence at once the construction of its lines. J. Searles, chief right of way man, announces that all arrangements have been made and no land disputes will block progress.

BILLINGS, MONT.—The city council has passed an ordinance granting Yegen Brothers a franchise for the construction of an electric street railway. According to the ordinance the company must begin the actual work of construction of the road within nine months, and must have at least three miles of track laid within two years. It is stated by Yegen Brothers that they will begin at once the work of building the road.

TOWANDA, PA.—A number of citizens residing in Warren and Pike townships have effected an organization, the object of which is to promote the building of a trolley road between Leraysville, Warren Center, West Warren, Pa., and Nichols, N. Y. The following officers were elected: president, Dr. J. C. Tripp, Warren Center; vice-president, Honorable N. W. Pendleton, South Warren; secretary, M. A. Sleeper, Warren Center; treasurer, F. D. Robbins, Leraysville.

KEOSAUQUA, IOWA—At a meeting of the directors of the Fairfield-Keosauqua-Memphis Interurban company, the proposition of Donald C. Fitzgerald, of New York, for financing and constructing the road, was accepted and the contract signed. Fitzgerald gave a bond of $100,000 for the completion of the road from Fairfield to Keosauqua by July 1, 1908, and for its completion to Memphis, Mo., at a later date. A dam is to be erected across the Des Moines river here, and power generated for the operation of the road.

SHAMOKIN, PA.—The Shamokin & Mount Carmel Railway, which has for the past three months been tied up by a strike, has been purchased by a syndicate headed by W. E. Harrington, who on September 1 resigned as general manager of the Eastern Pennsylvania Street Railways Company. Monroe and Gilbert Kulp, of Shamokin, are associated with Mr. Harrington. The names of the other members of the syndicate are not made public. It is understood that for a time at least Mr. Harrington will take upon himself the active management of the company.

BIRMINGHAM, ALA.—The Tidewater Development Company has filed notice with the Probate Court of an increase of capital from $100,000 to $150,000 in accordance with a decision made by its directors on August 22. This company has surveyed and obtained the rights of way for an electric car line from Gadsden to Tuscaloosa *via* Birmingham and through these cities, and proposes to build the road at an early date. At Tuscaloosa it proposes to have a barge line operating from there to Mobile for the transportation of freight. Senator Joseph F. Johnston is said to be interested.

DENVER, COL.—Final surveys of the Interurban Construction Company's electric line from Denver to Greeley have been started, preparatory to beginning work on actual construction of the enterprise, according to E. N. Reaser, one of the officers of the company. Rights of way and franchises in Denver, Adams and Weld counties have been secured by the company. Facilities in Brighton, Lupton, Platteville, La Salle and Greeley, through which the line will pass, have also been secured. The system will cost about $1,500,000 to construct and equip. The money for the enterprise has already been promised by Kansas City people, who have agreed to take the bonds to be issued. It is the purpose of the syndicate to have the line built and in operation by next spring.

CHEYENNE, WYO.—The Cheyenne city council has passed an ordinance which grants to W. J. Barker, president of the Northern Colorado Power Company and vice-president of the Denver Gas and Electric Company, a franchise to construct and operate an electric street railway in Cheyenne. Work on the railway is to begin within ninety days and the main line is to be in operation within six months. The main line will start at the Union Pacific depot, go straight northward through the business section, make a detour around the state capitol grounds and run thence to Fort D. A. Russell. The line will be about five and one-half miles in length, including two feeders in the city. Power will be derived from the new plant which the Northern Colorado Power Company is constructing here. The estimated cost of the system is about $100,000.

BOSTON, MASS.—The railroad commission has issued an order on the petition of the Boston & Providence Interurban, Boston & New York, Boston, Lowell & Lawrence, and Boston & Eastern Electric Railroad companies for certificates of public exigencies for the construction of roads. The order says: "A certificate ought to be issued to the Boston & Providence Interurban Electric Railroad Company, as the company by comparison is in better position to make use of it for public advantage. The future of the New York & Boston Electric Railroad is far more uncertain and speculative, its success being dependent upon the ability of the company to prosecute the enterprise in other states. As the Boston, Lowell & Lawrence Electric would interfere with important extensions to the Boston Elevated, this company and the Boston & Eastern Electric Company have been denied certificates." F. J. Wood, engineer for the Boston & Providence electric railway, says that work on the construction of the line will start next spring.

TELEPHONE AND TELEGRAPH.

SHELL LAKE, WIS.—The Basham Valley Telephone Company will extend its line to Baronett and Timberland.

MOUNT VERNON, N. Y.—Mount Vernon has refused a franchise to the State Line Telephone Company. The company has made a new application for the desired privileges.

GREENVILLE, S. C.—The Southern Bell Telephone Company has closed a deal here for a building site for its central office, which will be erected probably within the next few months.

FREDERICKSBURG, VA.—A new telephone line will soon be in operation in the Northern Neck. It will extend from Oak Grove and Colonial Beach to this city, and will have in operation sixty telephones. The new service will include points on both the Rappahannock and Potomac rivers.

VANCOUVER, WASH.—Orders have been received at the barracks here to provide for a wireless telegraph station in Washington. A board has been appointed, consisting of Lieutenant-Colonel Soloman, W. Roessler, Engineer Corps, and Major George T. Bartlett, Coast Artillery Corps. They have received orders to proceed to Fort Worden, Wash., for the purpose of selecting a site for a station.

WATERLOO, IOWA—At an adjourned session of a special meeting of the stockholders of the Corn Belt Telephone Company, held in the exchange building of that company, it was voted to increase the capital from $300,000 to $500,000. The new organization has been in operation twenty-six months. During that time its subscribers' list has grown from 2,500 to 6,694, an actual gain of 4,194 telephones, or 167 per cent.

BUNCETON, MO.—At the annual meeting of the stockholders of the Speed Telephone Company the following officers were elected: A. H. Eichelberger, president; G. P. Morton, vice-president; Gussie Harness, secretary; D. E. McArthur, treasurer, and George K. Crawford, J. A. Hosp and Henry Wendleton, directors. The officers and three directors constitute the controlling board. The company is in a most prosperous condition.

VERMILION, S. D.—Notice has been served on the Northwestern Telephone Company to remove all poles and wires in Vermilion within sixty days. The order is a result of the company's refusal to accept the franchise offered by the city. The company has operated without a franchise for two years. Ex-Governor Andrew E. Lee has accepted the new franchise requirements and will organize a company to put in a new system.

INDUSTRIAL ITEMS.

THE JANTZ & LEIST ELECTRIC COMPANY, 808 Elm street, Cincinnati, Ohio, has moved to Western avenue and York street, Cincinnati.

THE UNITED BRASS MANUFACTURING COMPANY, Cleveland, Ohio, maker of brass goods for use with water, gas and steam, is distributing a large hanger calling attention to its product.

FRANK W. MORSE, Boston, Mass., manufacturer of lighting specialties, announces his removal from 116 Bedford street to his new quarters at 514-516 Atlantic avenue, where all correspondence should be sent.

THE NATIONAL BATTERY COMPANY, Buffalo, N. Y., in bulletin No. 52 describes and illustrates unit accumulator storage batteries for isolated plants. This bulletin will be sent to any one interested upon request.

THE BROWN HOISTING MACHINERY COMPANY, Cleveland, Ohio, has ready for distribution a new bulletin devoted to "Brownhoist" locomotive grab-bucket cranes. This bulletin will be sent to any one interested upon request.

THE TRUMBULL ELECTRIC MANUFACTURING COMPANY, Plainville, Ct., is distributing a folder descriptive of its "Kappa" switch, designed for use with National Electric Code fuses. The company will be pleased to send this folder upon request.

THE ECONOMY ELECTRIC COMPANY, Warren, Ohio, is distributing some interesting literature relating to its "Economy" and "Bright" lamps. Some very attractive prices are quoted, and explanatory matter concerning deliveries and freight is included.

THE WESTERN ELECTRIC COMPANY announces that its London, England, office address has been changed to Norfolk House, Victoria Embankment, W. C. J. E. Kingsbury is the general manager. The London offices of the Western Electric Company have been at 171 Queen Victoria street.

THE PRINGLE ELECTRICAL MANUFACTURING COMPANY, 1906 North Sixth street, Philadelphia, Pa., has published a new catalogue devoted to Pringle specialties. This includes illustrations and data concerning type "H" switches, type "S" switches, panel-boards, iron and wood boxes, switchboards, accessories, receptacles and other specialties.

THE GOHEEN MANUFACTURING COMPANY, Canton, Ohio, has published a series of very interesting tests of the spreading power of carbonizing coating, red lead and graphite paints. These tests were made at the Columbus shops of the Pennsylvania Railroad last year by William T. Magruder, professor of mechanical engineering, Ohio State University.

THE GENERAL ELECTRIC COMPANY, Schenectady, N. Y., has published a very handsome bulletin, No. 4531, devoted to the Curtis steam turbine generator. The printing and general style of this bulletin is very attractive, and the engineering data concerning superheat, vacuum, economy and details of construction will be found of great value to all interested in this form of prime mover.

THE BRISTOL COMPANY, Waterbury, Ct., is about to erect a new addition to its present plant. This new structure will be fifty-three feet by 170 feet, three stories high. The additional facilities are made necessary by the increased demand for Bristol's recorders and Bristol's patent steel belt lacing. With the amount of business already in sight it will not be long before even this additional building will be crowded.

THE INSTRUMENT AND METER REPAIR COMPANY, New York city, has been organized to repair all makes of electrical measuring instruments and meters. A feature of the work of this company will be the prompt restoring of defective meters to circuit. The company will repair defects in the meters and bring them up to proper registration, but will not undertake meter calibration. The workshop is at 237 Fulton street, and the office at 203 Broadway.

WILLIAM H. SCHEEL, manufacturer of gums and chemicals for use in connection with varnish, rubber and lacquer making, etc., is again located at his old headquarters, 159 Maiden Lane, New York city, which was recently destroyed by fire. A very complete line of products is carried in stock, many of which are of interest to the electrical trade. Mr. Scheel issues a buyers' list and a prices current, which will be sent on request to those interested.

THE H. W. JOHNS-MANVILLE COMPANY, 100 William street, New York city, has published catalogue No. 110, describing Morris metallic packing. The company has taken the exclusive sale of this packing, which is patented, and which is manufactured by the Morris Metallic Packing Company. The packing is adapted for unusually severe conditions as applied to the valve stems of Corlis type engines and turbines. It is also supplied for air, hydraulic, gas and ammonia service.

THE LOOMIS-PETTIBONE COMPANY has been incorporated to do a consulting engineering business, with offices at 2 Rector street, New York city. The company will adhere to the work with which it has been identified for many years, and will continue to specialize in the design, construction and operation of power, fuel and illuminating gas plants, and their application to industrial, mining, municipal and central power station work. The members of the company are Burdett Loomis, Hawley Pettibone, H. A. Kimber and C. Lee Straub.

EUGENE MUNSELL & COMPANY, the well-known dealers in mica, and the Mica Insulator Company, manufacturer of "Micanite" and other high-grade electrical specialties, for many years located at 218 Water street, New York city, have removed to 68 Church street, corner of Vesey street. Owing to a large increase in business, these companies were compelled to seek more commodious quarters. The new location is one of the most central in the downtown business district, being one block west of Broadway and within five minutes' walk of the principal railways and ferries. The companies occupy four floors at the new location, the second floor being devoted entirely to the offices, while the other three floors are used for stock and shipping departments, for the preparation and assorting of mica, and for the manufacture of mica specialties.

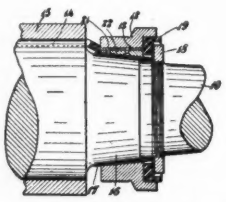
Record of Electrical Patents.

Week of September 24.

866,639. AUTOMATIC TELEPHONE RELEASE. Edward D. Fales, Chicago, Ill., assignor to Automatic Electric Company, Chicago, Ill. A grounded trunk release circuit extended through the automatic switches.

866,643. PRESSURE CONTROLLER. James H. Glenn and Michael Reule, La Fayette, Ind. A controller for an electrically driven air-compressor.

866,645. ANTI-HUMMER FOR TELEPHONE AND TELEGRAPH LINES. Nels O. Hagen, Pekin, N. D., assignor of one-half to Ole O. Forde, Pekin, N. D. A pliable tube placed around the wire.

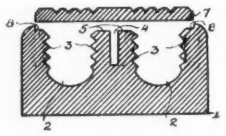


866,667.—MEANS FOR FASTENING COLLECTOR LEADS.

866,646. CONTACT DEVICE. Clarence J. Harter, Ilion, N. Y. A pivotally mounted trolley pole and shoe.

866,667. MEANS FOR FASTENING COLLECTOR LEADS. Emil Mattman, Norwood, Ohio, assignor to Allis-Chalmers Company and the Bullock Electric Manufacturing Company. The collector is mounted on a cone-shaped sleeve.

866,709. SUPPORT FOR ELECTRIC CONDUCTORS. William W. Benson, Philadelphia, Pa. A conduit or molding with corrugated sides for grasping the wires.

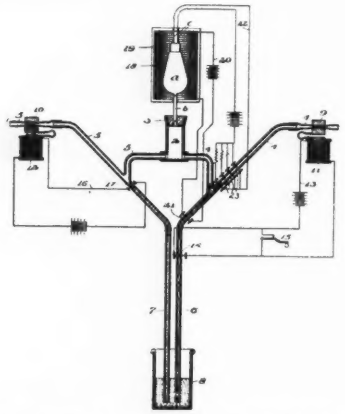


866,709.—SUPPORT FOR ELECTRIC CONDUCTORS.

866,714. TELEPHONE SYSTEM. Henry P. Clausen, Chicago, Ill., assignor to American Electric Telephone Company, Chicago, Ill. A central exchange system.

866,716. MANUFACTURE OF ENCLOSED FUSES. Robert C. Cole, Hartford, Ct., assignor to Johns-Pratt Company, Hartford, Ct. An enclosed fuse with indicator wire.

866,729. TROLLEY. William Moeckel, Jersey City, N. J. A trolley head with wire-guards.



866,751.—METHOD OF EXHAUSTING INCANDESCENT-LAMP BULBS.

866,735. CIRCUIT PROTECTOR. Charles A. Rolfe, Adrian, Mich., assignor, by mesne assignments, to Rolfe Electric Co., Rochester, N. Y. A heat-responsive device of a high-resistance graphite.

866,748. BATTERY ZINC. Henry C. Thomson, Boston, Mass., assignor to Electric Gas Lighting Company, Boston, Mass. A sheet of zinc with the edges turned over.

866,751. METHOD OF EXHAUSTING INCANDESCENT-LAMP BULBS. Frank L. O. Wadsworth, Pittsburg, Pa. A method of controlling the exhausting of incandescent-lamp bulbs.

866,760. POLARIZED RINGER-MAGNET. Francis H. Whitman, Cambridge, Mass. A method of construction.

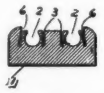
866,770. ELECTRIC-CONDUCTOR MOLDING. Sidney M. Burk, Philadelphia, Pa. A molding with adjustable groove.

866,794. INTERCOMMUNICATING TELEPHONE. Charles E. Lee, Chicago, Ill., assignor to Electric Goods Manufacturing Company, Boston, Mass. A system with a push-button call.

866,810. ELECTRIC LAUNDRY-IRON. Earl H. Richardson, Ontario, Cal. A method of construction.

866,846. ELECTRIC LOCOMOTIVE CONTROLLER. Charles O. Dayton, Washington, Iowa. An automatic block-signal system.

866,858. APPARATUS FOR DEPOSITING METALS. Wilbur A. Hendryx, Denver, Col. A combined filtering and depositing cell.



866,770.—ELECTRIC-CONDUCTOR MOLDING.

866,859. APPARATUS FOR DEPOSITING METALS. Wilbur A. Hendryx, Denver, Col. A filtering medium is interposed between anode and cathode.

866,945. ELECTRIC SIGNALING ON RAILWAYS. William J. MacKenzie, Dunmurry, Ireland. A system for signaling to moving trains.

866,959. ELECTROPLATING APPARATUS. Louis Potthoff, Flushing, N. Y. A device for moving the material being plated through the cell.

866,990. ELECTRICAL MEASURING INSTRUMENT. Thomas W. Varley, New York, N. Y. An instrument of the D'Arsonval type.

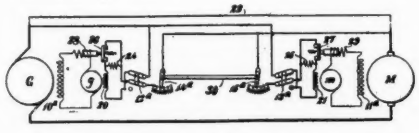
867,014. TELEPHONE EXCHANGE SYSTEM. Edward E. Clement, Washington, D. C. A common-battery system.

867,125. TROLLEY-WHEEL SUPPORT. George W. Grisdale, Jr., Philadelphia, Pa. A spring-supported harp.

867,140. MOLDING FOR ELECTRIC WIRING. William H. G. Kirkpatrick, Philadelphia, Pa., assignor to Kirkpatrick Manufacturing Company, Philadelphia, Pa. A molding with interlocking keeper.

867,150. RAILWAY SIGNALING APPARATUS. Vincent L. Raven, Darlington, England. Signaling apparatus for moving trains.

867,151. RAILWAY SIGNALING APPARATUS. Vincent L. Raven, Darlington, England. An automatic system for moving trains.



867,154.—SYSTEM OF MOTOR CONTROL.

867,152. RAILWAY SIGNALING APPARATUS. Vincent L. Raven, Darlington, England. The signaling apparatus is arranged on a normally open circuit.

867,154. SYSTEM OF MOTOR CONTROL. Walter J. Richards, Norwood, Ohio, assignor to Allis-Chalmers Company. Series windings on the motor and generator are connected in parallel.

867,155. MOTOR-CONTROL SYSTEM. Walter J. Richards, Norwood, Ohio, assignor to Allis-Chalmers Company. A controller operable from several points.

867,168. CONTROLLER REGULATOR. Emmett W. Stull, Norwood, Ohio, assignor to Allis-Chalmers Company and the Bullock Electric Manufacturing Company. A notched member for regulating the movement of the handle.

867,180. VEHICLE-CONTROLLING APPARATUS. Granville T. Woods, New York, N. Y. An automatic system controlled by the speed of the car.

867,212. ELECTRICAL-CIRCUIT PROTECTOR. Charles A. Rolfe, Rochester, N. Y., assignor to Rolfe Electric Company, Rochester, N. Y. A heat cartridge with self-soldering circuit-opening mechanism.